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THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

Publishing Office, No. 42 Pine Street.

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

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CONTENTS.

☞ An asterisk (*) denotes an illustrated article

EDITORIALS—

New England Association of Gas Engineers..... 25
Sixth Annual Meeting of the American Gas-Light Association..... 25
Annual Report of the Richmond Gas-Light Co., Richmond, Va..... 25
How to Burn Gas..... 26
Tar, and the Absorption of the Illuminants in Coal Gas..... 26
Lighting by Electricity..... 27
On the Luminosity of Benzole, Etc..... 28
Lighting by Electricity..... 29
West of Scotland Association of Gas Managers..... 31
Loss of Gas through Pressure..... 34
The Keely Motor..... 34
Proceedings First Annual Meeting of the Oil-Gas Association..... 35
Water-Gas for Heating Purposes..... 35
Sanitary Aspect of Artificial Light..... 36
The Electric Light in Factories..... 36
The Lowe Gas Process..... 36
Gas-Light Intelligence..... 37
On Some Candles Altered by Long Exposure of Sea Water 37
Gas, Gas, Gas..... 37
Analysis of Australian Shale..... 38
Possible Use for a Constituent of Gas-Lime..... 38

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit Correspondence for publication from all among them who make the study of these subjects a pleasure, or a profession.

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NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.

The next Semi-Annual Meeting of the Association will be held at the Allyn House, Hartford, Connecticut, on Wednesday, August 14th, 1878, at 12 o'clock, noon.

The first day and evening will be devoted principally to business, and a visit to the Works of the Hartford Gas-Light Company. On the second day an excursion by steamer is proposed, closing with a banquet.

GEO. B. NEAL.
Secretary.

Boston, July 11, 1878.

SIXTH ANNUAL MEETING OF THE AMER. GAS-LIGHT ASSOCIATION.

OFFICE OF AMERICAN GAS-LIGHT ASSOCIATION,
150 BROADWAY, N. Y. CITY.

To the Gas Fraternity of America:

The many benefits ensuing to the illuminating gas manufacturers of America, from the formation of the American Gas-Light Association, have been so clearly stated by the AMERICAN GAS-LIGHT JOURNAL, in its editorial columns, that they need not be repeated at this time.

For the information of those interested in gas-making, not members of the Association, the two following sections from the Constitution are copied:

"IV. To be eligible as an active member, a person must be a President, Vice-President, Director, Secretary, Treasurer, Engineer, Consulting Engineer, or Superintendent of a Gas Company, or an Individual Manager of a Gas Works, or a Person practically skilled in the construction and management of Gas Works."

"XXVII. Active Members shall pay an initiation fee of ten dollars, and the sum of five dollars annually thereafter, which shall be paid in advance."

CHARLES NETTLETON,
Secretary.

ANNUAL REPORT OF THE RICHMOND CITY GAS-LIGHT COMPANY, RICHMGND, VIRGINIA.

We have just received the Annual Report of the Committee on Light, and the Superintendent of the City Gas Works, Richmond, Virginia, and have taken therefrom the following items:

Gas on hand, Jan. 31st, 1877		526,478c.f.
Gas made per station meter, cu. ft.	87,630,200	
Less 10 per cent. leakage and condensation	8,763,020	78,867,180
Total		79,393,658
Less amount on hand Jan., 1878		481,929
Amount consumed.		78,911,729
Total public consumption		19,170,829
Total private consumption		59,710,900
Gas lost from breakage of main		30,000
		78,911,729
Disbursed for coal		$36,998·98
Disbursed for expenses.		78,495·61
Total disbursements		$115,495·59

Maximum consumption in 24 hours, 367,700 cubic feet.

Coal purchased, 19,246,800 pounds, or 8,592 gross tons.

Coal used during the year, 19,749,230 pounds, or 8,816 6-10 tons.

Coke made during the year, 336,887 bushels.

Coke used in the retort house, 189,532 bushels.

Shell lime used in purification, 35,079 bushels.

Total length of mains laid, 242,819 feet, or 45 and 98-100 miles.

Total number of public lamps, 1,188.

Illuminating power of the gas, 16·96 candles.

To make the matter a little clearer we will now transpose some of the preceding items as follows:

$\frac{87,630,200}{19,749,230} = 4{\cdot}43$ c. ft. yield of gas per lb. of coal.

And $4{\cdot}43 \times 2240 = 9{,}923{\cdot}2$ cubic feet. Yield of gas per gross ton.

$4{\cdot}43 \times 16{\cdot}96 = 75{\cdot}13$ candle-feet. Yield per lb. of coal.

And $9{,}923.2 \times 16{\cdot}96 = 168{,}297$ candle feet. Yield gross ton.

$\frac{87,630,200}{35,079} = 2{,}498$ cubic feet. Gas purified per bushel of lime.

This is a much larger quantity of lime than is generally used in other works; but if the Despard, Clarksburgh, Murphy Run coals, and the like, from Western Virginia, were used, it can easily be accounted-for.

$\frac{336,887}{8,816{\cdot}6} = 38{\cdot}2$ bushels coke made per gross ton of coal.

$\frac{189,532 \times 100}{336,887} = 56$ per cent. Proportion of the coke used in the retort-house.

$\frac{59,710,900 \times 100}{78,911,729} = 75$ per cent. Proportion of the gas used by private consumers.

$\frac{107,298{\cdot}85 \times 100}{87,630,200} = 1{\cdot}22$ dollar. Cost of the gas per M., when distributed.

$\frac{36,998{\cdot}98}{8,592} = 4{\cdot}30$ dollars. Price paid per gross ton of coal.

Average Diameter of the Mains.

8,184 feet	× 2 inch	=	16,368
129,888 "	× 3 "	=	389,664
68,952 "	× 4 "	=	275,808
20,791 "	× 6 "	=	124,746
1,947 "	× 8 "	=	15,576
3,919 "	× 10 "	=	39,190
2,566 "	× 12 "	=	30,792
6,343 "	× 14 "	=	88,802
229 "	× 20 "	=	4,580
242,819 feet.			985,526

Hence—

$\frac{985,526}{242,819} = 4{\cdot}06$ inches. Average diameter of mains.

And—

$\frac{8,763,020}{45{\cdot}98} = 190,583$ cubic feet. Gas lost per mile of main.

According to the census of 1870, the City of Richmond contained about 51,038 inhabitants.

☞ How to Burn Gas.—The attention of our readers is called to the advertisement of the pamphlet on "How to Burn Gas."

This little book is intended for gratuitous distribution among gas consumers, and its circulation among them will be productive of much benefit.

The price of the pamphlet is only $10 per thousand.

[From London "Journal of Gas-Lighting."]

Tar, and the Absoption of the Illuminants in Coal Gas.

Sir, I observe in the last *Journal*, that Mr. W. White, of Abersychan, claims to be the first to have drawn the attention of gas engineers to the action of the dip in depriving the gas of some of its richer illuminants.

Whilst giving full credit to Mr. White for doing good service, by his pamphlet, in calling attention to this important matter (providing, at the same time, by means of his valve, a substitute for the dip), I cannot recognize the justice of the claim he puts forth.

The question, however, of priority in directing attention to the subject is of greatly less moment than the subject itself, which is one well deserving the thoughtful consideration of gas managers. It is principally with a view to ventilating the question that I write the present letter.

A simple gas is usually described to be a permanently elastic fluid, under the ordinary conditions of temperature and pressure. Coal gas, which is compound in character, does not answer to that description. When it has been distilled from the coal by the agency of heat, and issues from the retort up the ascension-pipe into the hydraulic main, there is carried in suspension, along with the permanently gaseous fluids, a number of hydrocarbon and other vapors, which condense at temperatures varying from about 160° or 140° Fahr. downwards.

These hydrocarbons contribute largely to the illuminating power of the gas, and it is, of course, desirable to retain them in the permanently gaseous form. Some of these hydrocarbons, especially such as are of the greatest density, are reduced to the liquid state by the mere mechanical reduction of their temperature; whilst others of them of equal specific gravity, and many of those of lower density, undergo a change from the gaseous to the liquid condition, by reason of the solvent or absorbent action of the liquid contents of the hydraulic main, through which, by reason of the dip, they have to pass; or with which, in the absence of the dip, they come intimately in contact. The former may be classed as hydrocarbon vapors, the latter as gaseous hydrocarbons. It is thus evident that the process of condensation commences at the hydraulic main, the results there produced materially affecting the quality of the gas.

Those hydrocarbons that are changed to the liquid form by this slight diminution of temperature, it is probably impossible to retain in the gas, under any circumstances whatsoever. With the more volatile, though still heavy, hydrocarbons, the case is different; the power of retaining them in the permanently gaseous form is within the bounds of possibility, and these are, therefore, of the greatest interest to the gas manufacturer.

A further class of hydrocarbons are not liquefied at all under ordinary conditions, and there should never be any difficulty experienced in keeping them in the gaseous state. I forbear here to do more than merely refer to the fact, well known to chemists and gas engineers, that the whole of the illuminants of the gas can be eliminated by the employment of certain means, and, indeed, they occasionally are, by the neglect of ordinary precautions.

Of the second class of hydrocarbons—viz., those which, though of high specific gravity, it is practicable to retain in the gaseous form, I shall now speak. Their retention in the gas, and how this is the most likely to be accomplished—or at least how best to remove all impediments to that end—greatly concerns the gas maker. I have assumed that the mere reduction of temperature between the retort mouth and the hydraulic main will not affect their gaseous condition. Under what other circumstances, then, are they condensed in the hydraulic main, and in the subsequent mains leading to the condenser? The answer is clear, and is what I have already indicated—viz., by the affinity which exists between them and the already liquefied hydrocarbons present in the mains.

Some remarkable notes, corroborating these views in several important particulars, are recorded by Mr. W. Young, being the result of a number of experiments made by the late Mr. Cusiter, in 1868, on the absorption of the light-giving constituents of coal gas by the heavy hydrocarbon oils, his attention being drawn thereto when experimenting with glycerine as a substitute for water in gas meters.*

After having satisfied himself that the disadvantages attending its use were not compensated by its advantages, he turned his attention to other liquids which he thought might be suitably applied for the like purpose. One of these was mineral oil of 840° specific gravity. The effect of this with 28-candle gas was to reduce the illuminating power to 14 candles; and with gas of 35 candles, to 16·1. During the winter of 1873–4 he repeated the experiments, and made some additions to the number. These included paraffine spirit of 768° specific gravity, the crude distillate of paraffine oil of 810° and 860° specific gravity, and blue oil of 895°, all at the temperature of 60° Fahr. In each case the action of the fluids on the illuminating power of the gas was appreciable, but was greater with the denser oils. On passing the 28-candle gas through the paraffine spirit of 760° specific gravity, at a temperature of 60° Fahr., the result was *nil*; when the temperature was reduced to 50° Fahr., the loss in illuminating power was five per cent.; and when the temperature was raised to 70° Fahr., there was a gain of seven per cent. On the other hand, by passing the gas through either of the heavy oils, the loss of light amounted to 65 per cent.; and on agitating the gas and the oil together, the light-giving constituents were almost entirely removed—the gas, after treatment, consisting of light carburetted hydrogen, hydrogen, and carbonic oxide. Mr. Young deduced from these experiments various facts of great interest, having reference to the means thus afforded of ascertaining the percentage of hydrocarbons in a given quality of gas, but these are foreign to the present subject.

In a further paper on the same subject,† accompanied by experiments, Mr. Young showed that so great is the solvent action of heavy hydrocarbon oil (boiling point 180° Fahr.), that hydrocarbons, such as olefiant gas, which are permanent gases at ordinary temperatures, may be reduced to the liquid form in passing through it. He further showed that if, instead of allowing the gas and mixed hydrocarbons to cool together, the gas, saturated with the vapor of the lighter hydrocarbon liberated by heat from the mixed fluids, were transfused into a separate vessel, thereby preventing the heavier hydrocarbon from coming in contact with, and reabsorbing the lighter, the gas would remain saturated with the vapor from the more volatile fluid.

These important facts lead to but one conclusion—viz., that the practice so largely pursued and recommended, of allowing the whole of the tar to flow along with the gas through an extensive range of pipes to the condenser, both being gradually cooled together in the passage, is founded on an erroneous estimate of the results that follow thereon, is highly objectionable, and must be condemned.

Mr. R. H. Patterson, with that wise insight which characterizes his investigations, recently gave expression to his views on that subject in an able article,† in which the fallacy of the prevailing opinions with regard to the practice of keeping the gas in contact with the tar is very clearly shown.

The cooling of the gas gradually is a provision the wisdom of which is unquestionable, and the plan of causing it to make the circuit of the retort-house in pipes is probably the best method of accomplishing that object; but the deposited tar in the hydraulic main, and in the foul main at the point, as near as can be ascertained, where its temperature has fallen to about 110° or 100° Fah.—the temperature at which its absorbent powers come into most active operation—should be drained away direct to the tar well by its own separate conductor.

The chief advantages hitherto believed to accrue from the lengthened contact of the gas with the tar are—first, the absorption by the latter of naphthaline that would otherwise be carried for

* Proceedings, West of Scotland Association of Gas Managers, Oct. 1874. (See *Jour.*, Vol. xxiv., p. 571.)

* Proceedings, West of Scotland Association of gas Managers, April, 1875. (See *Journal*, Vol. xxv., p. 803.)

† "On Keeping Gas in Contact with Tar." (See *Engineering*, Vol. xxii., p. 438.)

ward to be deposited, by reason of the decrease in temperature, in the mains on the works, and even in the street mains, service pipes, and the internal fittings on the premises of consumers; and, secondly, the absorption also of a considerable portion of the obnoxious sulphur and other compounds.

These advantages will not be forfeited by the direct removal of the bulk of the tar, because sufficient will be left in the circuituous gas main to absorb any excess of naphthaline vapor present, and even to assimilate a portion of the sulphur impurities. Besides this, as the general effect will be to leave a larger proportion of the gaseous hydrocarbons in gas, these, by virtue of the power which they possess in common with the liquid hydrocarbons, of assimilating—and, in this special case, of suspending—other hydrocarbons, will necessarily assist in retaining in the permanent form a portion of the naphthaline that would in presence of the greater bulk of tar, have been liquefied and deposited. By a similar train of reasoning, the fact of the inferior quality of the tar produced from the richer cannels, as compared with that from coal, may be explained.

In dealing with this subject, it has been assumed by some that no absorbent action is likely to result so long as the tar with which the gas is in contact, is at a temperature of about 100° Fah. and above, and that, therefore, the dip in the hydraulic main causes no diminution in the amount of hydrocarbon gases present. It has even been assumed that the tar in the main gives off a proportion of hydrocarbon vapor, and in this way increases the illuminating power of the gas. On reflection, however, it will be plain that this argument is altogether untenable, for it is scarcely possible to conceive that hydrocarbons which have already been liquefied at a high temperature can again, at a lower temperature, assume the gaseous or vaporous form. There can be no doubt that the tar has an absorbent action, less or more, at all temperatures, being greatest at the lowest, and this being so, the dip must have a prejudicial effect upon the illuminating constituents of the gas.

THOS. NEWBIGGING.

5, *Norfolk Street*,
Manchester, *May* 29, 1878.

[From the London Journal of Gas-Lighting.]

Lighting by Electricity.

[Translated from the "Journal des Usines a Gaz."]

[Concluded from page 6.]

But to this must be added the price of the apparatus, the interest on the money invested, sinking-fund, maintenance, cost of supervision, etc. And here comes in the art of making figures give the reply we wish to have. M. Fontaine, in a remarkable work, affirms that the electric light, in equal quantity, costs 75 times less than gas. M. Fontaine is an electrician. On the other hand, a pamphlet which I have before me proves that the electric light costs 1 fr. 65 c., when that of gas costs 1 fr. only. This pamphlet is reprinted from the *Journal des Usines a Gaz*. On both sides thers is exaggeration—one party wishes to conquer, the other to hold its position. Do not think that gas is menaced. That marvellous system of lighting which penetrates everywhere, lights our streets so admirably at dusk, cooks our dinners, and illuminates our guests—which is always present and always ready to work—this system of lighting, I say, has no rival, no enemy but itself—the high rate at which, to its misfortune as well as ours, it has been fixed by an unintelligent monopoly. Gas has before it an immense domain to conquer; private houses to light, kitchens to warm, and the old-fashioned chimneys to supersede. In the place of this future, what will the few luxurious establishments do that electricity will conquer and hold? Nothing but create a a great need of light, a need of which the gas companies will be called upon to satisfy. Far from losing by the electric light, they will gain; far from complaining, they will rejoice at it; well inspired, they would place themselves at the head of the movement which they could not resist.

And, after all, which is the dearer, gas or electricity? This is my sole reply: The Lontin company offer, under penalty, to provide all the apparatus, lamps, carbons, and everything required, and supply the light at the rate of 50 centimes per hour for 100 burners, on condition, be it understood, that light is to be taken for a long term add that a definite number of burners are to be supplied. In this room there are 14; the cost of light for a lecture of one hour's duration would therefore be 7 frs.

Although this lecture may have already lasted too long, I must at last come up to the real subject oi it—lighting. The trials that have been made up to the present time have left such unhappy recollections, that they have affected, and still affect seriously, the new system. If we notice daylight, we see, in cloudy weather, the whole sky lighted by rays coming from the sun. These rays are projected in all directions, and strike the ground, buildings, trees, and other objects upon the earth; there they are very widely diffused, cross each other in all directions, and furnish at all points a general illumination. If you notice a spectator in the midst of this picture you will see that he receives rays from all points, which thus becomes visible to him, and you will also notice that he sends back other rays in all directions, which in turn render him visible. Such is the natural arrangement that we have to imitate.

We must first of all imitate the sky; that is to say, we must concentrate at some point near the ceiling a great bulk of light, which is to be distributed over the persons present. To do that we must multiply the burners, conceal them from direct view, and, above all, cover up windows, shop fronts, and glass roofs. It is by these outlets that the exterior light enters, and the interior light escapes. Such are the rules which have been found to work so successfully at the Magasins du Louvre, and equally so in this hall. I was yesterday passing along the Quai de la Monnaie, and from there I saw, over the Pont Neuf, the beautiful light at the Belle Jardiniere illuminating and bringing out the architecture of this palace of industry. A little to my left rose, in desolate obscurity, a black and shapeless outline. It was the Louvre; and I asked myself if our ediles had not a duty to discharge towards our monuments and towards ourselves—namely, that of surrounding us with light, when it might be done so easily and so cheaply.

M. Jamin attributes the difference in the estimates of the net cost of the electric light to the various interests engaged either in gas-lighting or in lighting by electricity. But M. Jamin, who is a great *savant*, might, it seems to us, have given some more precise information—something capable of enlightening his audience. He limits himself to saying that 100 burners require, on an average, one horse power, and that it is sufficient to calculate the cost of one horse; but he also says, "to this must be added the price of the apparatus, the interest on the money invested, sinking-fund, maintenance, cost of supervision," etc. Well, that is precisely the question. It is impossible to produce anything whatever without investing capital, for which interest has to be paid and a sinking-fund provided. Did not M. Regnault prove, in a celebrated report, that gas only cost 2 centimes per cubic metre? Yet, although he was for 22 years Consulting Engineer of the Paris Gas Company, he never indicated by what means gas could be produced at that price. That was because he had simply taken into account the raw material. How many millions were sunk and lost before gas returned any profit on the capital invested! This *unintelligent monopoly*, as M. Jamin ought *not* to have called it in a scientific lecture now lights the city of Paris gratuitously, and many other cities and towns for ridiculously small sums. Is the electric light capable of doing as much? No. And why? Because the capital invested in the gas industry has been sunk progressively, and as the consumption has increased on a large scale, the general expenses have been distributed over a large number of cubic feet of gas; this divisor increasing more rapidly than the dividend, the quotient—namely, the net cost—diminishes. It is by relying upon this arithmetical operation that the electricians succeed in establishing very low cost prices. They set their machines at work, produce the light of 100, 200 or 1,000 Carcel burners, and divide the cost per hour by the number of burners; the quotient, which is as small as the number of burners is large, constitutes the net cost.

Let us, for example, take the lighting of the amphitheatre of the Sorbonne by means of 14 electric lights, equal altogether to 1,400 Carcel burners. It is evident that, by taking no account of the first cost of the motor, the electromagnetic machine, the wires, and the lamps, the cost of these 1,400 Carcel burners was small—7 frs. (5s. 10d.) for a lecture of one hour's duration, according to M. Jamin. But in the course of a year the lectures extended over perhaps as many as 30 hours—let us say 100 hours, to be quite over the mark—and let us put down 15,000 francs only (£600) as the cost of fitting up; we arrive at the sum of 150 francs only (£6) to add to M. Jamin's 7 francs, while the lighting of the amphitheatre by gas really costs 2 francs 20 centimes (1s. 10d.) per hour (44 burners at five centimes per hour), without any addition whatever.

A trial of this kind has been made in a brewhouse at Lyons. The contractor for the electric light undertook to light this brewery for a month at the same price as was paid for gas (7 francs per night), and give a much more intense light. At the end of a month's reciprocal gratification, the electrician proposed to the man of commerce to purchase the fittings and apparatus at a considerable sum. The latter gentleman did not take long to make his calculation, and has simply returned to gas lighting.

M. Jamin says that M. Jablochkof can place 37 burners on the same circuit. We are quite willing to believe him, but should be much more curious to see it. Of one thing we may satisfy ourselves at the Place de l'Opera, where there are eight electric lights, and that is, that each of these lights is furnished with *sixteen wires*.

We have only seen practically four Jablochkof candles burning upon the same current; but sixteen have been worked with the same Gramme machine in the dye-works of M. Bredin at Lyons. In that case, however, a little subterfuge was reorted to; there were four Gramme machines attached to the same shaft, that is to say, four distinct currents, and consequently four canalizations of copper wires. It is nevertheless true that the experiment made at Lyons with the machine which was afterwards used at M. Jamin's lecture

frightened the small holders of gas shares, and in a few days those of the Lyons company dropped about 100 frs. But there is nothing to fear; those shares have gone into the hands of those who are more confident in the future of gas, which is in no way compromised by the new light. *It is not all gold that glitters.*

[From Correspondence of the *Chemical News.*]

On the Luminosity of Benzole, Etc.

To the Editor of the Chemical News:

Sir—With your permission I should wish to offer a few remarks on the paper "On the Luminosity of Benzole, etc.," which your report to have been read by the Messrs. Frankland and Thorne at the last meeting of the Chemical Society.

Dr. Frankland claims credit for having pointed "out in 1852 that hydrogen, carbonic oxide, and marsh gas practically contribute nothing to the luminosity of coal gas, and that the only constituents of value were *benzole*, ethylene, propylene, butylene, and *acetylene*." (The italics are mine.)

I always thought that the non-luminosity of the flames of hydrogen and carbonic oxide had been known to every chemical schoolboy, and that the feeble luminosity of a fish-tail flame fed by *pure* CH_4 known at least to every *chemist*.

To pass to the positive part of Dr. Frankland's alleged discoveries in 1852, it is rather remarkable that he should then have insisted upon the importance of *acetylene* as a luminiferous agent. It is true the gas had been discovered many years before by E. Davy, but chemists had entirely lost sight of it, and it has always been my impression that it was *Berthelot* who re-discovered it, in 1859.

Now, as to the benzole, what I have to say is that in 1857, when I worked in Bunsen's laboratory, the existence of benzole in coal gas was there simply ignored; all the part absorbable by fuming vitriol was put down as so much "*ethylene*" plus so much "*ditetryl*." Now, in 1852, Dr. Frankland came fresh from Bunsen. *Bunsen's* knowledge of the subject could not have decreased between 1851 and 1857, and we have no evidence of Dr. Frankland at the time having added anything to what he had learned from his master.

I have not Dr. Frankland's original paper at my disposal, but from the abstract given in the *Jahresbericht* it appears that in his analysis he simply reported his sum total of the carbon "vapors" present in the part absorbable by fuming vitriol, and assumed the percentage of such carbon vapors to approximately measure the luminosity of the gas.

Dr. Frankland, at the time, of course, looked upon that carbon as having been present in the gas (substantially) in the form of *olefines*. If he had thought that any noteworthy portion of it consisted of benzol, and that this benzole had any considerable share in the lumiuiferous power of this gas, he would have said so; but he does not. *Nobody*, in fact, dreamed of the paramount importance of benzole as a light giver in coal gas until a little over a year ago it was *asserted* by *Berthelot* (as a sequence from an *erroneous* assumption), and *proved* by me in a paper "On the Proximate Composition of Coal Gas," which I communicated to the British Association, in Glasgow, in 1876, and subsequently published in your columns. In that paper I show that Berthelot's notion that ethylene could not publicly be present in more than traces in a pyrogenic gas is contrary to direct evidence; but I also prove that while hydrogen gas, impregnated with benzole to the extent of three per cent. (by vol. of C_6H_6 vapor) gives a brilliantly luminous fish-tail flame, a mixture of C_2H_4 and hydrogen containing the same percentage of carbon vapor yields a flame like that of a Bunsen's burner.

In the introduction to my paper I distinctly stated that I was engaged in attempting, *by synthetical experiments, to determine the extent to which the several constituents of coal gas contribute to its luminosity.* A copy of my paper was forwarded to Dr. Frankland.

After the above I leave it to you and your readers, Mr. Editor, to form your own estimate of the merits of Dr. Frankland's latest scientific publication.—I am, etc.,

W. Dittmar.

Andersonian College, Glasgow,
January 30, 1878.

[From Correspondence of the *Chemical News.*]

ILLUMINATING POWER OF BENZOLE, ETC.

To the Editor of the Chemical News:

Sir—In his letter (*Chemical News*, vol. xxxvii., p. 61) Dr. Dittmar, criticising two papers of mine which he had never seen, asserts (1) that I *claim credit* for having pointed out in 1852 that hydrogen, carbonic oxide, and marsh gas contribute nothing to the luminosity of coal gas, and that the only constituents of value were benzole, ethylene, propylene, butylene, and acetylene. (2) That Bunsen in 1857 did not know of the existence of benzole in coal gas, and that as I came "fresh from Bunsen" in 1852, and have added nothing to what I have learned from my master, it followed that I also could not know of the existence of benzole in coal gas until in 1876 I was informed of that fact by Berthelot, and had seen the *proof* of it by Dr. Dittmar.

The practice of criticising papers from inner consciousness is, in this country at least, not a common one, and the result of your correspondent's attempt is not encouraging. If Dr. Dittmar will read the paper by Mr. Thorne and myself (when it is printed) he will find the following to be the only sentence to which his first assertion can have any reference:

"As early as the year 1852 it was pointed out by one of us that hydrogen, carbonic oxide, and marsh gas practically contribute nothing to the light of coal gas, and that the only constituents of this gas having any substantial value as light-giving agents are those hydrocarbons which combine with fuming sulphuric acid.—*Mem. of Manchester Lit. and Phil. Soc.*, 2d series, vol. x., p. 71."

So far from *claiming credit* for pointing out in 1852 that H and CO give no light Dr. Dittmar will find, if he will take the trouble to consult my paper of that year, the following statement.

"It has always been maintained that H and CO possess no illuminating power, and that the light emitted by coal gas is due to light carburetted hydrogen (marsh gas), olefiant gas, and other hydrocarbons."

What I did in 1852 was to distinguish sharply for the first time between the illuminating and non-illuminating constituents of coal gas. Before that year marsh gas had always been considered as one of the luminiferous constituents. Thus, Mr. John Leigh, the Chemical Adviser to the Corporation Gas Works in Manchester, and one of the best authorities on the chemistry of coal-gas, wrote in 1851*—

"There remain as constant ingredients of the gas, as at present manufactured, hydrogen, light carburetted hydrogen, olefiant gas, volatile hydrocarbons, and light-carburetted hydrogen, (marsh gas) alone contribute to illumination."

When, in 1849, I obtained absolutely pure marsh gas by the action of water upon zinc-methyl, I was surprised at the non-luminous character of its flame; again, in 1851, I observed in my investigations on the manufacture of gas, that the illuminating power of coal gas was not lowered by the substitution of hydrogen and marsh-gas; and, lastly, by sinking an iron tube through the peat of Chatmoss, near Manchester, I found that the natural marsh-gas which flowed abundantly through this iron tube gave, when burnt as a fish-tail flame, scarcely more light than hydrogen I brought up bags of the gas to London, and showed its non-luminosity to a large audience at the Royal Institution.

Dr. Dittmar's second assertion is equally devoid of foundation, for since the discovery and isolation of benzole in the liquid deposited from compressed gas by Faraday in 1825, and its subsequent extraction from coal tar, the presence of benzole in coal gas has, I presume, been known to all chemists. I cannot remember when I did not know it; and Mr. Leigh, in the paper just quoted, gives benzole with the formula $*C_{12}H_6$ in a tabular list of the constituents of coal gas. The assertion that Bunsen did not know it in 1857 is too preposterous for comment. From the notes of my lectures on technical chemistry, delivered at Owens College in the session of 1853–54, I copy the following—

"Constituents of purified gas are H, CH_2, (marsh gas), CO, gases and vapors having the formula †$CnHn$, and vapors $CnHn-_6$ . . . Vapors of the formula $CnH(n-_6)$, benzole, toluole, cumole. These are hydrides of radicals of the phenyl series. Being highly carbonaceous they emit great light, as is seen by passing H through benzole."

It is therefore evident that we do not owe our knowledge of the presence of benzole in coal-gas either to M. Berthelot or Dr. Dittmar. Neither has the latter furnished us with any additional proof of its presence, unless we are to consider as proofs such sentences as the following, quoted from his paper (*Chemical News*, vol. xxxvi., p. 145):

"It is true there *is* room for a little benzole." "These results render it highly probable that the light value of a coal gas depends far more on the proportion of benzole than on the proportion of olefines contained in it. This, however, has nothing to do with the question on hand." "After these experiences I *felt convinced* that, although coal gas as it comes out of the retort *cannot help* containing a considerable proportion of benzole, only very little of this vapor will survive the subsequent processes of purification." "Wishing very much to determine the exact ratio in the gas between the benzole and the olefines, I tried very hard to find out a quantitative method for their separation from each other, but I did not succeed." "The last substance I tried was non-vulcanised india-rubber, and if I may trust a few preliminary trials it *does seem* to have the power of abstracting the benzole from a gas without condensing much of the ethylene."

If vague impressions and convictions like these are to be accepted as proofs then farewell to the reputation of chemistry as an exact science.

Lastly, Dr. Dittmar has given no quantitative determinations of the illuminating power either of benzole or of any other constituent of coal gas, and I therefore fail to see that his paper anticipates, in any way whatever, the quantitative re-

* *Memoirs of the Lit. and Phil. Soc. of Manchester*, vol. ix., (2nd series) p. 265.

†C=6.

sults communicated to the Chemical Society by Mr. Thorne and myself, I am, etc.,

E. Frankland.

Royal College of Chemistry,
South Kensington Museum, Feb. 11, 1878.

[From Correspondence *Chemical News*, Mar. 8, 1878]

ILLUMINATING POWER OF BENZOLE, ETC.

To the Editor of the Chemical News:

Sir—What I meant to criticise in my former letter was Dr. Frankland's verbal communication to the Chemical Society, as reported in the *Chemical News* of Jan. 28. At the time when I wrote it was perhaps a little rash of me to simply assume that the reporter substantially reproduced what the Doctor said, but since then that report has been fully confirmed by Dr. Gerstl in his letter to the *Berichte der Deut. Chem. Gesselt.*, and, besides, Dr. Frankland does not impugn its correctness. Hence I now feel assured that his report is correct, and, more especially, that the sentence which I quoted between inverted commas does reproduce the very words of the speaker. With the memoir which Dr. Frankland is going to *print* I can have nothing to do. If in it he means to substitute "hydrocarbons which combine with sulphuric acid" for the words "*benzol, ethylene, propylene, butylene, and acetylene*," which he used at the meeting, why it only proves that Dr. Frankland does not care to re-assert before the whole of the scientific world what he has already asserted before the Chemical Society.

Dr. Frankland says that he collected bags full of marsh gas from a marsh near Manchester, and showed the non-luminosity of fish-tail flames fed with it to a large audience at the Royal Institution. To this my "inner consciousness" adds that, at the same lecture, the Doctor showed the combustion of a piece of phosphorus in oxygen. Does it follow that he was the first to observe the brilliant luminosity of burning phosphorus? But really, it is scarcely worth while now to enquire who it was that first observed that a fishtail consuming marsh gas is almost non-luminous, since I have proved that even ethylene—*as a constituent of ordinary coal-gas*—is "non-luminous" in the same sense (though of course not in the same degree) as marsh-gas.

Is there any need of my specially affirming that I never suspected Bunsen or any other chemist of being *ignorant* of the presence of benzole in coal gas? According to *my* knowledge of English, "*ignoring*" a thing does not mean to be "*ignorant*" of it; and all I said of Bunsen was that (in his method of coal gas analysis) he "*ignored*" the presence of benzole, and did not even find it worth reporting as being included in the "C_2H_4" and "C_4H_8;" for the very same reasons as those that caused Dr. Frankland (in his analyses of 1852) to simply determine the carbon vapor present in forms absorbable by vitriol, without discriminating between benzole-carbon and olefine-carbon.

It is quite true that somewhere in my paper I say "There *is* room for a little benzole." But these words, as everybody sees, are used only as formulating the result of a recalculation of part of the coal gas analysis which Bunsen gives in his "Gasometrische Methoden." It also is true that I *did* express in my paper a doubt as to whether coal gas, as used by the consumer, can possibly contain more than a minute fraction of the benzole which was present in it when it left the retort. But this is not, as Dr. Frankland insinuates, a "*vague impression*," but a legitimate conclusion from experiments which *proved* that benzoated hydrogen, when kept over water, soon loses the better part of its luminosity (and accordingly of its benzole), and from my analysis of the bromides which I had extracted from Glasgow gas, and which turned out to consist, *substantially*, of $C_2H_4Br_2$ mixed with a little of the next higher homologues.

If, notwithstanding these results, I pronounce it "highly probable that the light-value of a coal gas depends far more on the proportion of benzole" (small as it is) "than on the proportion of olefines which it contains," this "vague impression," again, is founded upon experiments which proved that, for equal quantities of carbon-vapor per unit volume of gas, benzole is infinitely more luminous than ethylene. What good would it have done if I had determined, photometrically, the exact ratio of the luminosities of the two flames, and calculated it to so and so many decimal places? Probably, in Dr. Frankland's eyes, this would have turned the "vague impressions" into a piece of "exact science." In my mind exact science is nothing more nor less than correct observations and close logical reasoning founded upon these and upon established propositions.—

I am, etc.,

W. Dittmar.

Anderson's College,
Feb. 19, 1878.

Lighting by Electricity.

[Translated from *Le Gaz*]

We hear it said every day that lighting by electricity is making progress, because the electric light has been fitted up in the Place de l'Opera, at the Hotel du Louvre, at the office of the *Figaro*, and at the Belle Jardiniere. In our opinion that is not progress, but simply an expedient, like that resorted to 20 years ago, when the clothing establishment on the Boulevard St. Martin was lighted by means of the electric lamps then in use.

The apparatus of present day are undoubtedly improvements on those of that period. The Jablochkoff "candle" is certainly a happy combination that suppresses the regulator; the electric machines of the Alliance Company, and those of Gramme and Lontin, are undeniably preferable to Bunsen's electric batteries. But if the apparatus have been improved, have the effects also been improved?

We remember that in 1857 or 1858 the galleries of the Conservatoire des Arts et Metiers were thrown open the whole of one evening to visitors, who had been invited by General Morin. On that occasion the light was effected by the electric light, with Serrin regulators; the excess of luminosity being absorbed by opaque glasses. The grand inner staircase was splendidly illuminated by two luminous focuses; and although the *soiree* lasted till nearly midnight, the light never for a single moment failed. There was the same brilliancy, the same intensity that we have today; and, moreover, there were the same hopes, the same promises, the same aspirations, the same certainty of success. Twenty years have passed since then—twenty years which have demonstrated the practical inefficaciousness of the system upon which so many hopes were based for the future.

It is true that during these twenty years active minds have sought to overcome this weakness, and that their researches have resulted in the construction of more perfect generators; machines have replaced the pile—the candle is substituted for the regulator. This is undoubtedly real progress; but the effect produced remains the same. There is still too powerful a light, which is offensive to the eyes, and requires to be considerably modified after it has been produced. In this respect no advance whatever has been made, for we are still unable to produce a light of less illuminating power than that given by 50 gas-jets.

People talk of the divisibility of the light; but what has actually been arrived at is simply the multiplication of the luminous focuses upon a single current. That is far from having attained what is, strictly speaking, divisibility, which consists in reducing the light furnished by a luminous centre to its very lowest proportions. In this respect we are still as powerless as in the past; and, besides, can this multiplication of focuses upon a single current really be effected? It is certainly open to doubt, when we observe what takes place in each lantern in the Place de l'Opera. In each group of five lanterns, there is, in fact, only one, and that the highest, which is lighted by electricity. Well, for this single electric focus, *twelve* wires have been employed. Twelve wires for a single light, when people boast of supplying twelve focuses from a single current! That is a contradiction which is strikingly palpable.

However, we find that the progress that has been made is attended by the same phenomena we witnessed years ago. The new system is employed to attract the attention of the crowd, and, as the crowd applauds the results obtained, it is thought that the process is ripe for serious work; then people get excited, and the bases of a great *Compagnie Parisienne d'Eclairage par l'Electricite* are very quickly laid down, and the eternal shareholder is called upon to subscribe the capital necessary for the enterprise.

But then something very curious occurs. The promoters of the Jablochkoff "candle" made trial of several electrical machines, in order to ascertain which one appeared to them to be the most efficacious, the safest, and the most economical. They naturally tried some experiments with the Shepard machine, which is the property of the Alliance Company, and as for a time they thought they had found some advantages in the employment of that machine, they said so, and their words were repeated, and even printed. What their motive was for not persevering in the use of that machine we do not know; but they lost no time in returning to their opinion, or to their error, we are not quite certain which. However, this temporary preference opened to the view of the Alliance Company an unhoped-for era of prosperity. The history of this company is well-known. Originally established for extracting hydrogen gas from water by means of electricity, with the aid of a Clarke-Nollet-Shepard machine, the company, notwithstanding several successful trials made in the presence of the Emperor, were never able to extract, for commercial purposes, a single cubic metre of gas from the raw material they had intended to use. But as their object was to work the water-gas industry, they obtained concessions for lighting Sens and Toulouse—with *coal* gas! These concessions were soon got rid of, and the company applied their Shepard machine to the production of the electric light. It was said that they were engaged to light some lighthouse; but in this they could not have been successful, as their shares had for a long time been unsought for. However, the experiments made with the Shepard machine had again raised their hopes, and the public were very soon invited to subscribe for 6,000 shares of 500 francs each in the *Compagnie Parisienne d'Eclairage par l'Electricite*, constituted by Acts of Jan. 22 and 31, 1878.

The object of this new company was, according to the prospectus, "the construction of apparatus and machines intended for the production of the electric light, and fitting up the same in manufactories, dockyards, commercial and industrial establishments, railway termini, harbors, vessels, lighthouses, public open places, parks, encampments, etc.; lighting by electricity, and all applications of electricity to the sciences, arts, and industry."

As a guarantee for the shares taken up, the company offered—

"1. The sole right to the stock-in-trade, patents, and processes of the old Alliance Company, whose apparatus, *by means of which the division of the light is obtained*, has been the object of several awards in the principal French and foreign exhibitions, and has recently been employed by MM. Denayrouse and Jablochkoff for lighting the Magasins du Louvre, the Belle Jardiniere, the *facades* of the Opera House, and the *Figaro* office, the building works of the Hotel Continental, and other commercial establishments. These apparatus, to which the company have the exclusive right, are indispensable in all cases where a fixed and constant light is required, and they alone are employed in the electric lighthouses that have been established in France and Russia, in the Adriatic, at the entrance to the Suez canal, and at other important points.

"2. The company's works, situated in the Rue Dufresnoy, Passy, with all the materials, tools, and manufacturing processes."

The advantages of the electric light over gas are then enumerated, and the prospectus continues:

"The welcome accorded by the public to the experiments which have demonstrated the incontestable superiority of this new process of lighting, and its general applicability, assure the company profits that will attain proportions unknown to any of our great commercial enterprises."

Finally, the hope of dividends is thus established—

"A working plant of 400 machines, distributing a light equal in intensity and power to that of 88,000 gas-jets—the lowest result, when compared with that which present needs and increasing demands lead us to forsee—will suffice to assure, according to certain calculations that have been made, a dividend of not less than twenty per cent upon the shares. Each share gives a right to a proportion of the profits, to the extent of eighty per cent.; the remaining twenty per cent. being disposed of at the rate of 15 per cent. to the board of direction and five per cent. to the reserve fund."

The shareholders were to pay 75 francs per share on application, and the balance of 425 frs. 30 days after the notice of allotment.

So much for the public. With regard to the Alliance Company, out of the entire capital of 5,010,000 francs (£200,400), they took as their share, according to the statutes, 5,000,000 francs (£200,000), leaving the new company with 10,000 francs (£400) only for working capital. It is true that the subscribed capital could be augmented by general meeting.

The Alliance Company's share of the capital represented—

	Francs.	Sterling.
Property belonging to the company situated at Passy, comprising offices, storehouses, and workshops, valued free of all liabilities, at.....	68,000	£2720
Materials, tools, instruments, machines made and in course of construction.....	74,890	2995
Amounts owing to the company, and vouchers of all kinds in their possession, including cash in hand.....	1,257,110	50,285
Designs, manufacturing processes, patents, etc..	3,600,000	144,000
Total.....	5,000,000	£200,000

There would only remain, therefore, for the new company the sum of 10,000 francs in cash, the value of 20 paid-up shares, the price for which would have to be paid in full at the time of application. Now, if there were only twenty shares to be subscribed for, why invite the public to take 6000, unless it was to assist the Alliance Company in realizing the greater part of their share of the capital? However, this matter does not come within our province.

On reading the prospectus inviting subscriptions for shares in the new company, the attention of M. Jablochkoff was aroused, and he caused a summons to be issued against M. Vidal, the director of the *Moniteur des Fonds Publics*, to compel him to insert in his paper the following reply to his previous articles:—

M. le Redacteur—In your numbers of the 24th and 31st January last, you inform the public that a company is in course of formation for the purpose of working some new processes for the application of the electric light, and you announce, in advance, that you reserve your co-operation until the approaching issue of shares, which is shortly to take place.

I should abstain from all reflection both on the conditions under which this company was formed and on the success you promise it in advance, if the enunciations mixed up with your opinion did not seriously affect the real facts, and at the same time my own personal interests.

Among the matters indicated by you as being about to engage the company's attention, you specially describe the electric candle, which I invented and have patented. Now, it is quite evident that as my assignees and I are the exclusive proprietors of this candle, no one else has the right to announce his intention of working it.

But this is not all. You advance the opinion that with regard to the machines intended to produce the electric current, they are the property of the Parisian company in course of formation, and that no other machines can possibly compete with them. This is a second error. I am not mistaken; I know personally that the Alliance company, who have now been transformed into the new company, have made and can still make machines producing an electric current.

But what is likewise true is that several other machines are in existence, over which the company have no control whatever, and I may add, without any necessity for explaining my motives in doing so, that after having myself utilised the Alliance machines, in applying them to the requirements of my patented invention, I have for some time past given the preference to others.

(Signed) JABLOCHKOFF.

The extra-judicial document added that the insertion demanded was of extreme urgency on account of the effect that would be produced upon the public by the notices and reiterated publications which had appeared concerning the formation of the new company, and it required the insertion of the preceding letter, without alteration, in a prominent position in the next number of the paper. This document was dated Feb. 9.

The next day MM. Denayrouse and Jablochkoff published the following circular:

Sir—You have, of course, received a prospectus which has been very widely circulated, of a company entitled the *Compagnie Parisienne d'Eclairage Electrique*, soliciting your aid in the subscribing of its shares. This is no other than an old company called the Alliance, for the transformation of which circumstances appeared favorable.

We should not have to occupy ourselves either with the company or their doings, if they had not caused our names to figure in a prospectus containing statements calculated to cause confusion, and supported by the rashest assertions.

In fact, the public will, on the one hand, be easily led to infer from it that the company asking for their capital have a right to work "the apparatus recently employed by MM. Denayrouse and Jablochkoff for lighting the Magasins du Louvre, the Belle jardiniere, the *facades* of the Opera House and the *Figaro* office, the building works at the Hotel Continental, and other industrial establishments." On the other hand, even supposing that the doubtful wording of the prospectus on this first point is susceptible of a less absolute interpretation, it is undeniably clear when it affirms that the machines of this company "are indispensable to every application of electricity where a fixed and constant light is required."

Now, we cannot allow such an equivocation or such a statement as this to be propagated under the apparent cloak of our names. We, therefore, boldly declare—

1. That we, and those with whom we have associated ourselves, are the sole registered proprietors of the lighting processes that have already been applied in the places specified in the prospectus in question, and hence it follows that the *Compagnie Parisienne d'Eclairage Electrique* have no right whatever to work them.

2. That the machines represented by the company as being *indispensable* to us are so little so that, after we had ourselves personally used them, we abandoned them, in order to adopt others more simple, more powerful, and four times less costly.

We have nothing to add at present to these declarations, and you sir, will understand the spirit of fairness—to speak of that only—which dictates them to us. We could not, by our silence, accept a share of the moral responsibility of the undertaking for which your co-operation is solicited. We need not here qualify the means employed by the company, but we shall point them out to all whom it may concern, and we consider it our duty also to point them out to the public, in order that our names may not be mixed up with the possible consequences of this undertaking, as, by a strange abuse, they have been mixed up with the statements we have noticed above.

[Signed) L. DENAYROUSE.
P. JABLOCHKOFF.

Notwithstanding this circular, the public subscription still continued to be announced to take place on the 22d and 23d of February; but a few day's before the 22d a notice was posted up one morning at the bank from which the shares were to be issued, announcing that the subscription was deferred until the 8th and 9th of March, and in the afternoon of the same day, according to the papers, the intervention of the Commissary of Police caused the projected subscription to be adjourned indefinitely.

Why? That is the question of the day in the matter of lighting by electricity. How will it be solved?

THE CONSUMPTION of gas in the House of Representatives is very large, about 5,500 cubic feet per hour, there being 1,228 burners.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,

PROPRIETORS.

Editor—G. WARREN DRESSER.

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TUESDAY, JULY 16, 1878.

Official Report of Examinations of Gas for two Weeks ending July 13, 1878, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

July 1878.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
1	Between 9 A. M. and 11.30 A.M.	15.67	16.38	20.34	17.14	15.99	
2		15.42	16.15	20.65	16.60	16.10	
3		16.13	16.72	20.80	16.66	16.22	
5		16.17	17.30	19.43	16.94	16.57	
6		16.49	16.04	18.55	16.40	15.86	
	Average	15.97	16.51	19.95	16.74	16.15	
8		16.07	16.60	20.10	16.98	16.10	
9		16.63	16.08	20.95	17.25	16.34	
10		16.56	16.77	20.62	17.15	16.46	
11		16.55	16.56	20.00	16.86	16.79	
12		16.34	15.81	20.04	17.14	16.39	
13		16.16	16.02	19.79	16.43	16.21	
	Average	16.38	16.30	20.25	16.97	16.38	

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

[*From Coal Trade Journal*]

ST, JOHN, N. B., GAS-LIGHT CO.—At the annual meeting of the St. John, N. B., Gas-Light Company, on the 4th of June, the following gentlemen were again unanimously re-elected directors for the ensuing year: Robert Blair, John Sears, John Boyd, D. Caldwell, Charles Patton, John Wishat, John Tucker, John Parks, and James L. Dunn. At a subsequent meeting o the directors Robert Blair was re-elected President

West of Scotland Association of Gas Managers.

[Concluded from page 14.]

Mr. DAVIDSON (Dawsholm)—I should like to ask Mr. Aitken whether he has made experiments as to the permanency of the increase in illuminating power through the use of benzole, and whether, if the gas has to travel a considerable distance, there is no difference in the increase at its utmost limit.

Mr. HISLOP—I have listened with great interest to this paper to-day. I can corroborate Mr. Aitken's remarks on the matter of the absorption by gas of those hydrocarbons deposited on the surface of the water in the tanks and drips in the streets. A number of years ago a chemical manufacturer called upon me, and represented that he had discovered a very large quantity of benzole floating on the water inside the gasholders, and he brought a special pump to prove the existence of the oil, and really it was found to the depth of five-eighths of an inch in the gasholder. After consideration of the subject, I conceived that there would be no gain in pumping up these oils by the means he suggested, as I guessed that they would be utterly useless. In the summer, however, I found that the whole of the benzole had disappeared. There was not a single vestige of it to be found on the surface of the water in the gasholder. It, therefore, seems that the gas drops these oils in the winter months, and that in the summer it takes them up again, when the temperature is higher, and the gas in that condition to which Mr. Aitken has referred, and the illuminating power of the gas is thereby increased. The same thing might be said about the drips, if there was any convenient means of lifting the oils out. But I see some difficulty in putting the diaphragm into the drips, so as to compel the gas to go down. There might be a danger of the oils flowing up, and putting some sections of the town into sudden darkness. I can, in the main, however, corroborate the views of Mr. Aitken as to the quality of the gas after taking up these hydrocarbons, as that is quite within my experience, and I believe, in the case of a town where the drips in the mains are not large, the same thing will take place, and the illuminating power of the gas in summer will be increased by the deposit in winter. It is a fact within my experience that we can give higher illuminating power of gas in summer than in winter, and I believe it is altogether attributable to this fact, that the gas takes up in summer a large portion of the hydrocarbons which have been deposited in cold weather. Upon the whole, I think that Mr. Aitken has contributed some very important matter to the science of gas lighting, in showing the effect of dry gas, and its power of retaining those hydrocarbons. I propose a hearty vote of thanks to Mr. Aitken for his paper.

Mr. DALZIEL—I can corroborate Mr. Hislop in his remarks about the oil being deposited on the surface of the water in the holders. During the winter a quantity of greasy matter gathers inside the holders, and I have further noticed that in summer weather, by putting in low-class coals, equal to 23 or 21 candles, the illuminating power was equal to winter. The only reason I could give for this phenomenon, which I have noticed for years is, that the hydrocarbons stored and collected during winter were absorbed by the gas during summer, and made use of then. I think if naphthas are deposited at one time of the year they are taken up at another.

The PRESIDENT—I suppose the reason why no other member desires to speak is, that we are all agreed upon what Mr. Aitken has said, and think that he is on the right track. I will now ask Mr. Aitken to reply.

Mr. AITKEN—In answer to the question of Mr. Davidson as to the permanency of the gas after the absorption of the benzole, I should explain that the experiments were not made with the view of ascertaining that. They were made to ascertain correctly how much benzole it takes to increase 10,000 feet of gas a candle, or four candles, or whatever it might be; or, to put it otherwise, to see how many gallons of benzole it would require to increase the illuminating power of ordinary 25 candle gas four or five candles, and to see what was the effect of a given quantity of benzole with a given quantity of gas. Perhaps people hold different opinions upon the power which the gas might have to carry off the benzoles. As I apprehend, it depends upon the temperature. It may be, however, that if the gas comes out of the holder cold, and, after passing into the streets gets heated, it would certainly have the power of permanently carrying benzole naphthas along with it. If, on the contrary, when the gas reached the pipes the temperature was reduced, I have no doubt the gas would drop the benzole. It is entirely a question of temperature. What Mr. Hislop said about gas in summer being richer from the hydrocarbons picked out of the gasholder, is quite true. By the deposition of these hydrocarbons in the winter an advantage is obtained in summer, but it is not in the summer that you want this advantage most. Winter is the worst time to keep up a good quality of gas, and by dropping the benzole in winter you drop it at the very time when it is most required. Then, as pointed out by Mr. Dalziel, not only is the benzole on the top of the water, but benzole covers every pipe, and, of course, in summer the gas has not only to take the benzole off the top of the water, but it has to wash the benzole off all the surface pipes, or, at all events, every pipe where a deposition has been made when the temperature was low. I do not suppose you will get this deposition to a great extent in houses, unless the gas is made from shale at a low temperature, when I know the naphthas, or benzole, or whatever other term you may apply, settle down at a higher temperature than those made by ordinary coal gas.

The vote of thanks proposed by Mr. Hislop to Mr. Aitken for his able paper was cordially given.

Mr. DALZIEL (Kilmarnock) read the following paper

ON A NON-TILTING GAS-METER.

The subject I now bring before you, namely, that of a non-tilting gas-meter, is one, I am certain, which will be appreciated by many of my brethren. Happily some of us are so fortunately situated that a meter of this sort is not required. Others again, especially in manufacturing towns, have been much annoyed by parties tilting their meters, abstracting the water, and obtaining their gas at merely a nomina rate.

The custom of parties who are in the habit of doing this is, that after the inspector has called and filled the meter with water, to let the meter register correctly for a few days, then tilt it forward, run off as much of the water as they can, and let it remain in that state till near the time they expect the inspector to make his usual call; then the meter is set level, filled with water, and, as a matter of course, it is found all right when the inspector calls, though he may be suspicious that the meter has been tampered with.

I am sorry to say that I have been much annoyed with consumers of this kind. I have been under the necessity several times of punishing, by fine, consumers for tilting and drawing water off their meters, and I have often failed in detecting parties of whom I was suspicious, on account of the hours they burned the gas, the size of the burners, or other circumstances, that the amount of gas registered was not anything like what it should have been.

During the winter of 1875-76 especially, my attention was directed to this matter. I was aware there were non-tilting meters that did their work efficiently, but the means taken were cumbrous, and not adapted for general use. I considered there ought to be a simple remedy to get the better of these parties, and, if possible, to make the pressure of the gas subservient to retaining the water in the meter, instead of blowing it out. In the non-tilting meter now before you I believe I have succeeded in obtaining this.

You are all aware the water in a wet meter is one of the sides of measurement, and it is only when the meter is standing level that it will give correct regis

tration; the standard of the range in the water line being 2 per cent. in favor of the company and 3 per cent. in favor of the consumer, being a range of 5 per cent.; but if we tilt forward a meter, this range can be increased to 10 per cent., or 12 per cent. in favor of the consumer. If we tilt forward a meter, the water in the measuring chambers of the meter flows forward into the front box, rises above the water level, and overflows into the waste water chamber, thereby lowering the water level in the drum of the meter only.

If we take a meter when newly filled with water it registers 2 per cent. in favor of the company, but if we tilt this meter with a quarter of an inch underneath the hind feet, this will run off three-quarters of a gill of water, and register one per cent. less; with half an inch beneath hind feet it registers correctly.

With ¾ inch there is 2 p. ct. slow = a loss of 4 p. ct.
" 1 " " 3½ " " = " 5½ "
" 1¼ " " 5 " " = " 7 "
" 1½ " " 6 " " = " 8 "
" 1¾ " " 7 " " = " 9 "
" 2 " " 8 " " = " 10 "

And with 2¼ inches underneath the hind feet, the drum of the meter stops. Up to this point, there are seven gills of water run off, or, roundly, seven-tenths of a gill of water for every querter of an inch the meter is tilted, and an average loss of gas of 1¼ per cent. for every quarter of an inch of tilt. Now, when we have tilted a meter 2¼ inches, and run off the water to point, if we gently set back the meter to 1¼ inches of tilt, there is still this no registration, the drum of the meter standing still; now lower it to 1¼ inch tilt, and the meter moves off again, but with a loss of 10 per cent., which is equal to 12 per cent. from the highest point, namely, when the meter is newly filled with water, while at the same time the supply of gas is not in the least interfered with, the reason of this being that, although fully three-quarters of a gill of water is run off for every quarter of an inch put under the hind feet, the water level being, as it were, the centre point where the angles of the water lines converge, and although a large quantity of water is drawn off the meter, the lowering of the level in the front box is inappreciable. Its level being scarcely altered keeps the float up, and the gas entrance open, the gas passing right through the meter without causing the drum to move, and of course, no registration takes place.

In the valve I now bring under your notice, I believe I have succeeded in producing an effective check on all who desire to obtain gas surrepticiously by tilting the meter and drawing off the water, as no gas can be got unless the meter is standing level.

Having fitted up several meters, I found Cowan's patent side valve most suitable for my purpose. The meters of other makers fitted with this valve did not do so well, as the action of the float was intermittent, the water rising and falling with the pressure of the gas, and permitting a portion of the water to flow into the waste chamber each time the float rose and fell; but with Cowan's patent side valve, the pressure in the water level chamber is constant, and does not permit the water to rise above the water-line when the meter is tilted. but is forced down by the pressure of the gas into the back of the meter, and kept there so long as the meter is tilted, the water-line in the water-level chamber being lowered to the same extent as the pressure of the gas; that is, if there is an inch of pressure, the level will be lowered in the level chamber half an inch; if two inches, one inch, etc.

In experimenting with a Warner and Cowan meter, by tilting it forward up to a certain point there is no loss to the company; thus the meter standing level gains two per cent:

Tilted ¼ of an inch.....1 per ct. fast.
" ½ " .....1 "
" ¾ " .....2 " } As near as may be.
" 1 " .....2 "
" 1¼ " .....2 "
" 1½ " .....2 "
And at 1¾ " .....the meter stopped.

I came to the conclusion that, as the valve was intended for a certain class of consumers, Warner and Cowan's meter is most applicable.

In general the gas entrance to the drum of a meter is placed in the center of the front box, between front and back. In this meter the gas entrance to the drum is brought close to the front plate, and a conical valve with back balance is placed on its mouth in the waste chamber of the meter. When the meter is standing level it is open, but when tilted forward, the balance, always hanging perpendicular, raises this valve and closes the mouth of the gas entrance to the drum, cutting off the supply of gas promptly; and, as before stated, the water, instead of flowing forward from the back of the meter, and rising above the water-line, and overflowing into the waste chamber, as in the common meter, is forced under the diaphragm back into the drum of the meter, and kept there so long as the meter is tilted, none of it overflowing into the waste chamber. Tho instant the meter is put into its proper position again the water flows back to its natural level, and registration goes on correctly as before. I consider this to be a most important advantage, namely, the retention of the water when the meter is tilted. I would especially draw your attention to this point, which is one of the strongest recommendations to the use of this valve; it is as good as a spirit-level; you can set it to cause the gas to go out at any point, one-eighth or one-fourth of an inch; but I find for general use, with three-fourths of an inch of tilt, that is, under the hind feet, it is quite sufficient as a check on tilters, and is an ample margin to keep the valve open when the meter is sitting level.

Suppose, again, that the gas should be turned off, and the meter tilted, the water will run off, as it has not the pressure of the gas to retain the water; but as the valve, on the entrance to the drum, is closed, the supply of gas is effectually cut off, so there is no help for a consumer who tilts but to set his meter level again; but as the water has been drawn off, although the valve is open, down goes the float and again cuts off the supply of gas, so there is no help for a consumer of this class but to fill up his meter with water, and let it stand level. By adding this valve to the meter, gas companies are doubly protected, and gas managers have an efficient check on consumers guilty of these practices

I have got a number of Warner and Cowan meters fitted with this valve, the working of which has been most satisfactory. Two years ago I put on some of Warner and Cowan's meters to several parties who were guilty of tilting; but it was of no avail, as when brought forward, it is like other meters, namely, the compartments of the drum of the meter being unsealed by the water being run off. Seeing I had not improved my position, it was only after a good deal of time and trouble have been able to circumvent them. In every case in which it has been applied it has wrought admirably. Now, when I have tested its efficacy, where I have the least suspicion, instead of watching, I put on a meter at once, and the result generally has been a large increase to the gas accounts of these parties, compared with the corresponding period of the former year. These parties, when they find the gas goes out if the meter is tilted forward, or if they draw water off the float goes down, will give up further attempts to obtain gas in this way.

A curious incident in connection with this is, that I invariably find those consumers who interest themselves in inquiring how much their neighbors consume, are fit subjects for a non-tilting meter. Their immunity from what their neighbors consider heavy gas accounts—who wonder how A could use so little and B so much gas, seeing that B went to bed early, and A sat up the most of the night—was a puzzle they could not get over. I now make it a rule, when the inspector comes across one of this class, who tell him they are only so and so, and inquisitive as to their neighbors accounts, to put one of these valve meters on at once, the result generally being a statement in excess of what they used to pay.

As gas managers, those of us who have meter inspectors are much indebted to those who discharge their duties faithfully. The question is often asked, "How many cubic feet of gas do you make per ton of coal?" I think a more practical question is "How much do you sell per ton?" as it is by what we sell our profits are made, so I consider a faithful inspector of meters is invaluable. Now that I have proved this meter to be effective, my inspectors find themselves relieved from one of the most disagreeable and irksome of their duties in connection with their office, as they have found that when a meter with this valve is put on to suspicious customers, it not only tells against the individual, but has a wholesome effect upon the neighborhood. As a rule, you will find these parties are grouped together. When you find one in a locality, you may be certain others of the same sort are not far off.

I will now read you a few of the results of the working of the meter with this valve:

Year.	August.	September	October	November	December	January	February	March	April	Trade.
1877 Common Meter.....	...	...	200	200	200	700	200	300	300	Tailor.
1878 Non-tilting Meter.....	...	...	600	500	400	500	500	400	300	...
1877 Common Meter.....	400	200	200	400	900	500	200	200	100	Brass Finisher.
1878 Non-tilting Meter.....	...	...	300	300	900	500	200	400	500	...
1877 Common Meter.....	...	200	200	900	...	...	...	...	...	Engineer.
1878 Non-tilting Meter.....	...	...	...	...	400	200	700	400	400	...
1877 Common Meter.....	...	...	...	...	...	600	500	300	200	Engineer.
1878 Non-tilting Meter.....	...	...	...	...	600	1000	800	700	500	...
1877 Common Meter.....	...	...	600	800	600	500	300	200	100	...
1878 Non-tilting Meter.....	...	...	300	700	600	600	300	200	100	...
1877 Common Meter.....	...	...	600	800	600	600	300	200	100	Hammarman.
1878 Non-tilting Meter.....	...	...	300	400	600	600	300	200	100	...
1877 Common Meter.....	...	...	300	400	600	600	300	200	100	One of small means.
1878 Non tilting Meter.....	...	...	300	400	600	600	300	200	100	...
1877 Common Meter.....	...	...	300	400	600	600	300	200	100	Writer.
1878 Non-tilting Meter.....	...	...	300	400	600	600	300	200	100	...
1877 Common Meter.....	...	200	200	900	...	...	...	...	...	Weaver.
1878 Non-tilting Meter.....	...	400	700	1000	1200	1400	600	1000	700	...
1877 Common Meter.....	400	...	...	...	...	...	...	...	...	Engineer.
1878 Non-tilting Meter.....	...	...	...	...	...	...	...	...	...	...

Now, what is the moral of all this? That we, as managers, should do the best we can in furthering the interests—and these are genuine British interests—of our employers, not only in taking the most we can out of the coal and other materials supplied to us, but also to see to it in the distribution, not only that our mains are sufficiently large and our service-pipes sound, but that our meters are the best that can be got, so that it will be out of the power of any consumer of gas to get more than he is entitled to, and that every company may realize every cubic foot of gas that passes through their meters.

The PRESIDENT—I am sure we are all indebted to Mr. Dalziel for his paper on this subject. It is one, however, that, perhaps, the least we say about it the better for ourselves, because many, if they knew how, might try their hands at tilting meters. At present very few practice this dishonest process; but at the same time it is well to have the power of checkin g

these very few. Therefore, Mr. Dalziel deserves credit for the meter valve he has invented. I would like to ask whether the gas valve increases the price of the meter.

Mr. DALZIEL—I forgot to state that the parties of whom I have made mention were not caught tilting. It was only when we found neighbors saying they could not understand how So and-so was charged so little for gas that the new meter was brought into play.

Mr. RICHMOND (Whitburn)—Eighteen years ago I was greatly troubled by people tilting their meters; but I managed to put an end to the practice by introducing the dry meter. This meter is quite handy. I have not had a case of tilting for sixteen years.

Mr. CARLOW (Port Glasgow)—The Port Glasgow Corporation bought a number of Mr. Dalzeil's meters lately, and we have found them to be of great advantage. We were troubled with suspicions about parties, and we fixed these meters at their premises, and the results have been very satisfactory, although only a few months have elapsed since their introduction. I am not in a position to give actual results, but at some future meeting I will lay statistics before the meeting to show the advantages derivable from the adoption of this meter.

Mr. AITKEN—I thought this was a question entirely pertinent to Kilmarnock, and that there was not another town in Scotland in which a gas manager could come forward and complain of his customers; but from what we have heard, there are other towns in the same position, and perhaps you will consider this being a question of morality, whether you should not inform the commission about to sit as to the morals of such and such a place.

Mr. SCOTT (Superintendent of the Meter Department, Glasgow)—I must say the principle of this meter is very good. I have much experience both of wet and dry meters, and I find the dry meter is very good where it has its work to do—that is, a five-light meter passing 30 feet per hour; but if you take a fourth off that as being the quantity used for a certain time, it is a question whether the consumer does not get more than the quantity he is charged for. Therefore I have always been in favor of the wet meter as the most correct measure in use—that is, always provided you get a perfect meter; and so far as I have seen, this appears to me to be a very perfect measure. I may tell you that it is the Laidlaw meter that we principally use. The spout goes into the centre of the cylinder. It does not matter how you tilt this meter you cannot take off the water, because the spout is the water-line, and it is as near the centre of the measure as you can have it. And, tilt it as you may, the variation of the measure is very little—I do not think above two per cent. I would advise all gas managers, if they want accurate measurement, they should go in for wet meters, and test them regularly, and there is no fear of a good return. I have a system of testing gas meters in Glasgow. By means of a mechanical arrangement tested by experiments at the works, the inspector can easily detect whether a dry meter is registering properly or not.

Mr. WATSON (Stirling)—Is this meter of Mr. Dalziel a patent?

Mr. DALZIEL—It is merely registered.

Mr. WATSON—How many have you in use?

Mr. DALZIEL—I have a dozen just now, but I am getting more.

Mr. WATSON—Can you, by using the meter, reduce the per centage of unaccounted for gas? I expect if you had 200, or 300, or 1000 of these meter, in use, that your leakage would be considerably reduced.

Mr. HUTCHINSON (Portrush)—From my experience nothing beats the old style of wet meter, provided proper attention is paid to it. With this attention there is no danger of the company being defrauded. I must confsss, however, that when a manager is dependent on inspectors, who are mostly ignorant of the construction of a meter, there is nothing better than a good check. In that view I much approve of he principle of Mr. Dalziel's meter. When the index is taken, not by the manager, as in small towns, but by inspectors, it is invaluable that the manager should have a meter on which he can place reliance. In comparing one year with another, I have found considerable differences in the returns, more especially with dry meters.

Mr. DALZEIL—The improvement only adds five per cent. to the cost of the meter. The most of the parties to whom I have referred have paid the additional cost in the first month. From my experience of dry meters I will have nothing to do with them, if I can help it. I saw from the JOURNAL OF GAS LIGHTING that there was not a single dry meter in the whole of France. As regards the morality of Kilmarnock that is a touchy point. The defaulters, however, are, in this instance, not Kilmarnock people; they mostly come from other places. Kilmarnock, therefore, is clear of this stigma. As to the reduction of leakage, I may say that Kilmarnock is a town that radiates from a center in long streets, like a spider with long legs. I send the gas out from the center in all directions, to the distance of one, two, or three miles; so that the leakage is about 14 per cent. I do not expect that the adoption of this meter will reduce the unaccounted-for gas very materially; but I consider that it is a meter which will make everybody pay what is right.

On the motion of Mr. LEVI MONK, a vote of thanks was awarded to Mr. Dalziel.

Mr. D. M. NELSON (Glasgow) read the following paper on

STEEL'S PATENT GRADUATORY GAS SCRUBBING, CONDENSING, AND PURIFYING APPARATUS.

In bringing the present short paper before this Association, it may not be out of place in me to say a word concerning the gentleman on whose behalf I appear, simply by way of introduction. Not that he is unknown in the world of engineering skill and enterprise, or that he has even been altogether isolated from the special section of engineering industry, to which we, as an Association, are more or less allied, but rather because he is, personally, somewhat of a stranger to most of you. I may say, however, that as a practical engineer and a brewer, he has done much to improve the quality and cheapen our glass of beer or stout by his improvements upon refrigeratory and other apparatus; that one of his inventions is what is known as the Steel and McInnis Railway Brake, a brake that has yet to be proved second to any other on trial at the present time; also that he has just published a work on brewing, which commands the price of ten guineas per copy.

Having thus briefly referred to these points in Mr. Steel's personal history, you may feel justified in believing that the process or system he propounds for the purification of gas is worth, at the very least, a few minutes of your consideration. He is desirous of gaining instruction and advice from you, while none the less willing to make himself useful to this or any kindred Association with which he may be brought into communion.

The machinery shown is meant to represent a method of purifying gas by what may be called a continuous graduatory process, and, at the same time, provide a simpler method of purification than at present in use. A pretty full description of this apparatus is given in the "Register of New Patents" column, JOURNAL OF GAS-LIGHTING, March 26, 1878, page 488.

The system ought to be made up of two long cylinders, one supplied with pure water for de-ammoniating the gas, the other for extracting the sulphur and carbonic acid by means of lime water, or milk of lime. To show one of these cylinders will at present be quite sufficient for the purpose of explaining the arrangement, that cylinder being the one devoted to the cooling and scrubbing operation. The purifying process is quite similar, the liquid lime being used instead of the pure water. In both cylinders the absorbing media should travel the reverse way of that in which the gas travels, so that in reaching the end of discharge, the gas, in a state approaching to purify, meets the pure water, or clean milk of lime, entering and moving in the opposite direction, at the reverse ends. On its entering the gas will, of course, encounter the absorbents, rendered as foul as can be allowed in practice, and ready for discharging. Thus the foul gas encounters the foul media of cleansing, and the pure gas the pure media.

The process is akin to what is called the "sparging" system, employed by brewers in the extraction of the saccharine products from malt, namely, that of sprinkling pure water on the top of the grains in the mash tub, and causing it to filter downwards, absorbing as it goes the substance of the malt, and increasing in gravity as it passes towards the bottom, where it drains out in full strength. This sparging operation is performed vertically, and is much simpler than the method which must be employed with gas. Here we must work horizontally; and the writer thinks a perfect horizontal the best position in which to place the cylinders, as thus the absorbents will be retarded, rather than otherwise, in their passage through.

For the purpose of retardation, diaphragms are attached at suitable distances along the cylinders. These, it is supposed will, while cutting the body of the liquor into sections keep each sectional quantity very much by itself in the intervals between the periods of supply, and so have the strength or foulness, and that of purity of the absorbents, in a state of graduation from one end of the cylinders to the other, to secure for them the greatest amount of saturation at the point of outlet.

To describe the machine shortly, let us deal with one end for the ammonia. To this the gas is supposed to enter, and be supplied with water from a cistern by means of cocks, together with some suitable pipe or connection. In action, however, previous to supplying pure water by the cocks, a quantity of liquor would have been drained off the opposite end of the cylinder and discharged into the tar pit or chest, through other cocks. The quantities run in and off must be measured in some way, and a general level maintained in the cylinders by arrangements of detail made for the purpose. Experiments are required to give dimensions.

After passing the ammonia cylinder, the gas enters the division for dealing with the sulphur, etc., and the action of the gas going the one way and the absorbent the other is repeated. The lime is supposed to be dissolved in a cistern, by some simple rousing apparatus, and run, as in the case of the water, into the proper end of the cylinder, there to move to the reverse end and be discharged into a pit or chest corresponding to that employed for the tar.

Objections were wont to be made to the use of lime in solution—its smell, and the difficulty in disposing of it were both complained of; but a greater difficulty stood in the way, namely, the imperfect method of application. The writer has seen nothing better proposed than a fixed vessel, which, to fetch the principle home to us, might be called a pot for containing the wet lime, and into this, to some depth, as a necessity, the gas had to be forced for contact. Apart from the bad effects of forcing, the result was not good, for the gas went through in belches, and was but indifferently purified. This meagre purification too, could only be had when the lime was newly put in and quite fluid, for it soon became too viscid to be penetrated, and too impure for purification.

The proposals of Mr. Steel obviate both the evils of viscidity and those of impurity, while recent proposals to use up effete gas-purifying products is likely to give a market for the contents of the liquid lime pit. In proof of this I refer to an article which appeared in the columns of the JOURNAL OF GAS LIGHTING a week or two ago.

The question of whether the cylindrical or other shaped vessels should revolve or be stationary, with shafts and arms to distribute the media of absorption has been considered, but is not decided on by the patentee. The thorough mixing of the gas and liquor is of the first importance, but there are so many ways of doing it, that it is left in the meantime for discus-

sion and experiment.

Fixed cylinders have the advantage that the fresh water, lime water, or milk of lime could be applied, and the products abstracted without any stoppage of machinery or the interruption of the process, while the rotating vessels will require special adaptations for this end. But this paper is read in the hope of showing a principle and means of gas purification yet virgin and untouched by gas makers, and which, it is thought, will give superior results to methods now being followed.

As regards the general improvement and simplifying of gas making (apart from purification) by the introduction of this system, it is supposed that the long purifying cylinders will allow of the condensers being done away with, as the exposure of the gas to the large superficies, with the thin material of the cylinders, will cool it amply in winter, and in summer the cooling deficiency can be made up artificially, by a sprinkling of water from pipes.

The cylinders being substitutes for the ammonia washer and the dry lime purifiers, it follows, if we can drop the condensers, that the cylinders at once take the place of all three. By this method all pressure is taken off the gas in its progress to the gasholder, and the only exhaustion required is the quantity of power to uplift this when being filled.

With the waste heat at disposal in the retort-flues of gas works, the question of power to work this system need not enter into either calculation or discussion, and so with the cost of up-keep. This cannot be more than that required for the present apparatus, while the labor will be much less than that expended on the purifiers, etc., of the present day. It looks as if Mr. Steel's system was attracting the favorable notice of gas engineers, as one or two patents trenching upon his ideas have been taken out recently, and the writer will now be glad to hear the views of the gentlemen of the West of Scotland Gas Managers Association on the matter.

In continuation of my paper, I may remark further that Mr, Steel in his patent foresaw that revolving shafts might be used instead of the revolving cylinder, and he now thinks that the cylinders ought to be made larger in diameter than he at first anticipated—say six or eight feet—so that men, in cleaning or repairing the interior, may be able to move about freely. Cylinders so large as this would be inconvenient to work on the revolving principle, and Mr. Steel now prefers the shaft with light arms to whisk the water about, mix the gas and water, and cause the gas even to strike down on the solid water creeping along the bottom of the vessel. In this case the vessel may be made round, square, or oval; possibly have a flat bottom, and a high oval or round top. With the flat bottom, the liquors might get a longer travel by moving zigzag, crosswise, with switching arms in each division.

But, as has been already indicated, the method is inflexible in the extreme, and may be adapted to work in many ways. In those proposals, with the whisking arms and spoon or paddle-float ends particularly, there would be no need of wood grids, or other form of scrubbing power, so that the labor, great or little, would be restricted to that of keeping the bottom clear of obstruction.

After the reading of the paper, it was proposed to postpone further discussion until the next half-yearly meeting, when Mr. Nelson hoped to have an opportunity of bringing forward more information on the subject. This was agreed to.

EXHIBITS.

The thanks of the Association were accorded to Mr. Foulis for his kindness in sending his lamplighter, which was explained by Mr. Scott.

A vote of thanks was also given to Messrs. W. and B. Cowan, and Mr. Nelson, for the articles exhibited, and also to Mr. Christie, of the Argyle Ironmongery Company.

VOTE OF THANKS TO THE PRESIDENT.

Mr. Mitchell—I have to propose a hearty vote of thanks to Mr. M'Gilchrist, for the able manner in which he has discharged his duties as President during the year which has just closed.

The President responded, and concluded by moving a vote of thanks to Mr. Carlow, Secretary, who he said, had really done all the work.

Mr. Carlow, in reply, said that in anything he had done for the Association he had great pleasure, and he would always be glad to put his services at the disposal of the Association.

NEXT MEETING.

It was unanimously agreed that the next meeting should be held at Kilmarnock.

On the motion of Mr. Nelson, a vote of thanks was given to the Committee of the Industrial Museum, who, through Mr. Young, Curator, had done so much to facilitate the comfort and convenience of the members.

THE REVIVIFICATION OF LIME.

The members then adjourned to Paisley Gas Works, where the manager, Mr. G. R. Hislop, conducted them through the works, and explained his process for revivifying lime.

Having partaken of some refreshments,

Mr. Hislop said—Mr. President and Gentlemen: I very highly value the honor conferred upon me and upon our town, in having appointed Paisley as the place of your meeting at this time, and above all I feel grateful to you for having elected me as an honorary member of your Association, and for the kind interest taken in my process for the revivification of spent lime, and for the expression of that interest which your presence here to-day conveys to me. In addition to the mechanical description of the lime revivifying chambers, to which you kindly listened a few minutes ago, I am glad to have this further opportunity of making a few observations on the practical working and general results obtained by the process. At the outset I need scarcely advert to the many occasions, such as the present, upon which the subject of utilizing spent lime has been discussed—and that not only in Scotland, but in England and elsewhere.

You already know that I have for several years past been directing my attention to realize that object, and I venture to say that my efforts have not been fruitless; since, in addition to a considerable saving in the cost of lime, all the workmen can testify to the very great convenience that has been experienced in its use—considered in relation to the amount of land occupied by the raw material (limestone) and by the spent lime, which unitedly in winter, commonly amounted to from 500 to 890 tons, and besides this, the exposure of men calcining stone during all seasons, and also the similarly disagreeable work of screening and preparing the new lime, which is very largely reduced in the preparation of the recalcined lime. The plan I follow out in ordinary practice is the employment of oxide of iron in conjunction with the lime, and by changing something like two of the former to one of the latter, the whole of the lime is completely desulphuretted by means of the carbonic acid contained in the foul gas. Lime that is employed in this way is found to contain, after some fifty-six recalcinations, only about two per cent. of sulphur. Another part of my process, and intended specially for works in which the purifiers are not arranged for the use of oxide of iron, is to draw, by a suitable exhauster the carbonic acid gas from the chimney, and pass it up through the foul lime in the purifier, in order to displace the sulphuretted hydrogen, which is recovered, into oxide of iron contained in a separate purifier or chamber; and after recalcination caustic lime is recovered. I am presently making a certain series of experiments, and amongst these, that of recalcining lime fully saturated with all impurities, and after seven restorations it contains about 4½ per cent. of sulphur. My friend, Mr. Stewart, has had the process in operation in the Greenock Gas Works for some months, and it continues to give satisfaction; but since its introduction there I have decided upon certain important modifications and improvements, which will, I feel confident, considerably increase the product of quicklime.

Within these last few days Mr. Young of Clippens, and myself have patented another arrangement, intended to take the place of the chambers you have just inspected—namely, a rotating or oscillating retort, as referred to by your President to-day, and which will be of special value to the larger gas companies and corporations. It will be necessary only to feed in and draw out the lime, and consequently reduce the labor to a minimum. An ordinary boiler-shell is lined with fire clay, and may consist of one or several tubes; and these, again, may have longitudinal or spiral ribs through them in order to expose the largest amount of surface. The tube is inclined towards a furnace and a receptacle for the burnt lime, and the heat given off during the process of cooling is utilized in increasing the temperature of the lime under recalcination. And something like 24 to 25 cwt. of quick lime per shift per man may be realized by my first process, and at about one-half of the original cost; probably considerably more by the rotating retort. In practice, from 50 to 60 per cwt. of the crude lime is returned as quick-lime.

With regard to the applicability of this process to small gas works, it may be introduced with advantage into works of any size, from 3,900,000 feet per annum and upwards. It not unfrequently happens that a man has unavoidably to be taken into service when there is not more than half work for him, and until an increased consumption of gas brings his full compliment of work, I would in such cases utilize his time by heating up the lime-revivifying chambers, and store up the burnt lime. As, depend upon it, you cannot err in having lime prepared a considerable time before its application in the purifiers, any carbonate that may form on its surface by exposure to the atmosphere being perfectly insignificant. In conclusion, I trust that our efforts will be crowned with that measure of success as will secure the profitable utilization of that material which has so long been held to be a nuisance and an abomination. In a word, I once more thank you, gentlemen, for having afforded me this opportunity of explaining my process.

THE DINNER

In the afternoon a large company sat down to dinner in the George Hotel. Mr. M'Gilchrist discharged the duties of Chairman, the Croupiers being Messrs. Nelson and MacLeod. Song and sentiment succeeded each other, and a pleasant evening was spent.

The Keeley Motor.—William D. Marks, Whitney Professor of Dynamic Engineering, and George F. Barker, Professor of Physics in the University of Pennsylvania, publish a report in the Philadelphia *Ledger* confirming the statements of Mr. J. B. Knight respecting the Keely motor. These gentlemen do not say that Keely is a fraud, but they evidently think so, and what they do say justifies the public in reaching the same conclusion. Mr. Keely invited such a conclusion when he first made his public boast that he could run a steamship across the Atlantic upon power obtained from, or out of, a glass of cold water. Probably we have heard the last of the Keely motor until some of the gentlemen who have put money into the company can't get it out again.—*Iron Age.*

Loss of Gas Through Pressure.—A high authority on gas matters in England, states that the loss of gas, through pressure unwisely permitted at the moment of evolution within the retorts, and by leakage through defective distributing plant amounts to 15 per cent. of the total quantity generated in the best managed concerns, to 30 or even 40 per cent. in those which are less efficiently conducted. That it is possible to prevent much of this loss seems probable. Individual makers have already succeeded in reducing their percentage of unaccounted-for gas to a moderate six or seven per cent., and the time is approaching when we shall be able to account on the right side of the balance-sheet for all but an insignificant portion of the entire weight of coal delivered within the retorts.—*The Plumber.*

Proceedings of First Annual Meeting of the Oil-Gas Association.

SHELBYVILLE, IND., May 8, 1878.

Pursuant to the foregoing call the following named gentlemen met at the office of the Shelbyville Gas Light Company:

J. R. Allen and V. Hatfield, Middletown, Ohio; W. S. Woodfill, Wm. Bracken, M. Grover and A. O. Smith, Greensburgh, Ind.; Joseph McLean, Washington, C. H., Ohio; N. C. McCollough, Anderson, Ind.; H. C. Thompson and R. F. Hughes, Cincinnati; J. H. Leefers, Aug. Deprez, George H. Dunn, A. J. Gorgas and G. W. F. Kirk, Shelbyville, Ind. They were called to order at 2 o'clock P. M. by J. R. Allen. On motion Dr. William Bracken was elected chairman, and G. W. F. Kirk, Secretary.

On motion the following committee were appointed.

To prepare and submit Constitution and By-laws—Allen, Grover and Kirk.

On Permanent Organization—Allen, McCollough and McLean.

On Business—Hatfield, Smith and Kirk.

The meeting then adjourned until 3 o'clock P. M.

3 O'Clock, P. M.

Meeting called to order by Dr. Bracken. Committee on Constitution and By-Laws reported, and were on motion discharged.

The Constitution and By-Laws as reported by committee were then taken up, and after discussion, and such alterations as were deemed best, were adopted as follows:

CONSTITUTION.

ART. 1—The name of the association shall be the Oil-Gas Association. Its aim shall be to unite the oil-gas manufacturers in the following objects:

I. To improve the science and art of manufacturing gas from oil, or any of its constituent elements, to the end that its cost may be cheapened, and its consumption and distribution increased.

II. To promote the diffusion of knowledge—scientific and practical—among the members of the Association; by social intercourse and friendly exchange of ideas and information in all matters relating to the construction and management of oil-gas works.

III. To encourage cordial relations between the manufacturers of illuminating gas and their patrons.

ARTICLE II.—OF MEMBERS.

This Association shall consist of active and honorary members, and shall hold its meetings annually.

ARTICLE III.—OF OFFICERS.

The officers of the Association shall consist of a President, two Vice-Presidents, a Secretary and Treasurer. To be elected annually by ballot.

ARTICLE IV.

Every proposition to alter or amend the foregoing Constitution, shall be submitted in writing, and may be ballotted for at the next annual meeting, and shall require two-thirds of the votes cast for its adoption.

BY-LAWS.

ART. I.—OF DUTIES OF OFFICERS.

I. The officers of the Association shall assume office immediately after the close of the meeting at which they are elected.

II. The President, or in his absence, the Vice-President shall preside at all meetings of the Association, and of the Executive Committee, at which he is present.

III. The duties of the Secretary shall be to keep correct minutes of the proceedings of the Association, and of the Executive Committee; conduct the correspondence of the Association, read all papers and communications—if the authors wish it—and perform such other duties as appertain to his department.

IV. The duties of the Treasurer shall be to collect and take charge of the funds of the Association. He shall pay no money except on the order of the Secretary, countersigned by the President; and he shall make an annual report, to be submitted to the Association.

ART. II.—OF THE EXECUTIVE COMMITTEE.

I. The affairs of the Association shall be managed by an Executive Committee subject to the control of the Association, by its action in general meetings.

II. The Executive Committee shall be composed of the officers of the Association for the time being, and the President, for the last presiding year.

III. All questions in Executive Committee shall be decided by a majority vote, and three members shall be a quorum.

IV. The Executive Committee shall report near the close of each annual meeting, a proper number of questions of scientific and practical interest—the answers to which may advance the interests of the gas industry—and shall procure the acceptance of as many such questions for investigation as may be practicable.

ARTICLE III.

I. Any gas company may become an active member of the Association by a two-third vote of the members present and the payment of $5. And any company so being a member may have the privilege of sending as many delegates to the meeting as they may choose. And such delegates shall have all the privilege of members, except that in such case the company shall have but one vote and must in all cases when represented by more than one, state who shall be entitled to cast the vote of the company.

Or any person practically skilled in the construction and management of gas works, may become a member on the same conditions as above stated.

II. Honorary members shall be gentlemen whose scientific knowledge in matters relating to the gas industry shall recommend them to the Association.

III. Every applicant for active membership shall signify the same in writing to the Secretary, addressed to the Association.

IV. Honorary members shall be proposed to or by the Executive Committee. The election of applicants for active membership, and of persons proposed as honorary members, shall be by ballot, and each person shall receive two-thirds of the vote cast, to be elected.

ARTICLE IV.

Active members shall pay a yearly contribution of Five dollars ($5) and the sum of Five dollars ($5) annually thereafter, which shall be paid in advance.

ARTICLE V.

No member or company whose annual payment shall be in arrears, shall be entitled to vote.

ARTICLE VI.

Honorary members shall not be required to make any payment or contribution to the Association.

ART. VII.—OF MEETINGS.

The annual meeting of the Association shall be held in such place where Oil Gas Works are established, as the Association may decide upon, on the second Wednesday and Thursday of May, each year.

ARTICLE VIII.

The Secretary shall send notice to all members of the Association, at least fourteen (14) days before each general meeting, mentioning the papers to be read, and any special business to be brought before the meeting.

ART. IX.—ORDER OF BUSINESS.

At the annual meeting of the Association the order of business shall be:

1. The reading of the minutes of the last meeting.
2. The election and introduction of new members.
3. Address of the President.
4. Report of the Executive Committee on the management of the Association during the previous year.
5. Report of the Treasurer.
6. Report of Special Committees.
7. Election of officers.
8. The reading of papers, of which notice has been given to members of the Society, and discussions upon the same.
9. General business.

ARTICLE X.

The ordinary rules of parliamentary bodies shall be enforced by the presiding officer, from whose decisions, however, appeals may be taken, if required by two members, and the meeting shall thereupon decide without debate.

ARTICLE XI.

Every proposition to alter or amend these by-laws shall be submitted in writing, and may be ballotted for at any subsequent session, when upon receiving the votes of two-thirds of the members present, it shall become a part of the by-laws.

Committee on organization reported, and on motion the Association went into the election of officers for the ensuing year, which resulted as follows:

President—W. Bracken, Greensburg.

First Vice Prssident—J. H. Leefers, Shelbyville.

Second Vice President—J. B. Pence, Crawfordsville.

Treasurer—N. C. McCollough, Anderson.

Secretary—G. W. F. Kirk, Shelbyville.

Committee on Business reported several topics for discussion. Report received and committe discharged.

On motion the Association adjourned to meet at 7 o'clock P. M.

7 O'Clock P. M.

Association met Mr. Bracken having been called home, Mr. Leefers took the chair.

Mr. W. P. Heron, of Crawfordsville, Ind., having arrived reported, and was welcomed by the members.

Mr. H. C. Thompson, Agent of the American Meter Co. being present with photometers and apparatus, proceeded to demonstrate the workings of the same, all of which proved satisfactory to the members present.

Then followed a free discussion on various matters connected with the gas business. Each member giving some statement of his experience, trials and successes. (This discussion was interesting and instructive, but from its nature cannot be presented in the Proceedings).

In consequence of the expense necessary in the organization and first meeting, the members voted to pay an assessment of $2 each in addition to regular fee.

Mr. H. C. Thompson, of Cincinnati, agent of the American Meter Co. was unanimously elected an honorary member of the Association.

An appropriation of ten dollars was made in favor of Mr. H. C. Thompson, Agent American Meter Co., in consideration of the advantage derived, and expense necessarily incurred in shipping and handling apparatus.

Mr. Thompson declined to accept anything whatever,

Appropriation of $5 granted to pay for printing call, postage, etc., for this meeting.

At a late hour the Association adjourned to meet again at Middletown, Ohio, on the second Wednesday of May, 1879.

G. W. F. KIRK, Secretary.

All companies and persons interested in the manufacture of oil or naphtha gas, are cordially invited to became members of the Association

Please address all communications to

G. W. F. KIRK, Secretary,
Shelbyville, Ind.

Water Gas for Heating Purposes.—An old idea, it seems, has been revived, and it is again proposed to distribute water gas for heating purposes. There can be no doubt that, if a really practicable method for its production on a large scale could be devised, some economy might result from its use; but it would be at great risks. Everybody knows that carbonic oxide, which constitutes a large portion of the gas, is a deadly poison. It is, moreover, odorless, and consequently an escape would not be noticed. There is, therefore, the double risk of asphyxia from its presence, and of explosion in consequence of the mixture of hydrogen.—*Journal of Gas Lighting.*

Sanitary Aspects of Artificial Light.

[From the *Medical Examiner.*]

Some time ago we called attention to some of the more prominent features of the question of artificial lighting in its economical aspect, and we now make no apology for turning to the important sanitary bearings of the subject. It is obvious that these must have especial reference to the vitiation of the atmosphere consequent on the combustion of the illuminating agent employed. It has been pointed out, that where a complete and effective combustion takes place, the only products formed are carbonic acid and aqueous vapor. In the case, however, of coal gas, in addition to these ordinary combustion products, small quantities of suphurous and sulphuric acids are formed, having their origin in the sulphur compounds always present in small but varying quantity in ordinary gas as it is supplied to the public. In the event of the gas containing ammonia as well as sulphur, nitrogen acids are likewise formed during combustion; but as London gas is practically free from ammonia, the question of nitrogen acids may be here omitted. The sulphur acids produced by burning gas are so exceedingly small in quantity, that it is only by refined chemical tests that their presence can be identified, and it has not been established that these special substances in such minute proportion have any injurious effect on health, although there has been much agitation on the subject among many not thoroughly acquainted with the question. The greatest objection to the presence of sulphur in coal gas appears to be the injurious action exerted by the combustion of it on articles of furniture, more especially those constructed of leather or bright metal. The action is, however, extremely low, and only becomes appreciable after a lengthened exposure of the articles in places, such as large shops, where great quantities of gas are being habitually consumed. In order to give the reader some idea as to the amount of these sulphur acids present in the atmosphere of an ordinary room where London gas is being burned, it may be mentioned that Dr. Odling and Mr. Keates have shown that the total quantity at any given time is very much less than would be produced by striking a common sulphur match.

In considering the general question of atmospheric vitiation from the use of various sources of artificial light, whether oil, gas or candles, the vitiating power which each material exerts on the surrounding atmosphere may, for all practical purposes, be measured by the oxygen withdrawn, and by the carbonic acid produced. The sense of oppressiveness felt on entering a room where a large amount of some combustible agent is being consumed, is no doubt due mainly to the presence of an undue quantity of carbonic acid, the correspondingly diminished amount of oxygen and the heated condition of the atmosphere being minor conditions.

In judging of the comparative vitiation produced by the commoner illuminating agents, the true mode of viewing the question is to ascertain the amount of oxygen required, and of carbonic acid produced, by the amount of each material necessary to be burnt in order to produce *equal quantities of light.* By this method of estimation, gas (of 16-candle value) stands highest on the list, followed closely by parffin oil, and then by sperm and colza oil, and candles of sperm, wax and tallow—that is to say, that in producing a given quantity of light, the least atmospheric vitiation is produced by gas, and the most by tallow candles. This statement is no doubt antagonistic to popular belief, for no idea is perhaps so generally received as that which attributes to gas a vitiation action far exceeding that due to the combustion of any other illuminating agent. This conception may be traced to the fact that in most cases where gas is used as a source of light, an amount of illumination is produced far exceeding in quantity that which would be generally obtained from oil or candles. In cases where we were formerly content with a couple of candles, or a single lamp, affording at most a light of six or eight candles, it is now often customary to employ a two or even a three-light gaselier, the burners of which give a combined light of from 16 to 24 candles. With such increased light there are corresponding and equivalent amounts of atmospheric heating and vitiation. The remedy is to be sought in more efficient ventilation, and when it is more thoroughly understood that an increased consumption of an illuminating agent must be attended with increased vitiation of the surrounding atmosphere, the unfounded abuse of coal gas which is so frequently heard will, it is to be hoped, entirely cease. The question of efficient ventilation is a most important one, the ordinary class of rooms being singularly deficient in any provision for either the egress of foul, or the ingress of fresh air. The accidental opening of a door, and the imperfect fitting of doors and windows, leaving small chinks and apertures through which some interchange may take place between the atmosphere of the room and the external air, are, as a rule, the only means by which a kind of ventilation, imperfect as it is inefficient, is carried out. Ventilating gas burners are, it is true, occasionally used, but their adoption is the exception rather than the rule, and it would need a somewhat extensive series of pipes to render such a system suitable to a private house where gas is used more or less in every room. The so-called "ventilating globe burners" consist of an ordinary gas burner surrounded by a globe, and suspended from the ceiling by means of a comparatively wide metal tube; within this tube is a smaller one used for conveying the gas, while the products of combustion ascend between the two pipes, and are carried away to the external air. The well-known "sun-light" is likewise a ventilating arrangement carried out by the same means. The best forms of ventilating burners have, in the pipe which takes away the products of combustion, a self-acting valve arranged in such a way as to prevent cold air descending the pipe when the burner is not in use.

It now only remains to consider the question of what is the best source of artificial light as affecting the eyesight. Very little knowledge of an absolute description is available on this branch of the subject, but it may be laid down as a general rule that flickering lights, and those of great intensity, are the most trying to the eyes. The Argand form of burner affords the steadiest and best light, and perhaps the arrangement which is least trying to the eyes is to be obtained by the interposition of a shade so placed as to screen all direct light-rays from the eyes, at the same time that sufficient illumination is obtained at the place required for work. A medium should also be chosen between too little light, on the one hand, and too much light on the other; for, in the first case, the eyes become strained in endeavoring to obtain correct vision, and, in the second place, they become dazzled by the excessive glare. The color of the object to which the eyes are directed is also a consideration. In the pursuit of literary work, for instance, a tinted paper will be found less fatiguing to the vision than if the paper is of a pure white color. Dr. Croft has recently called attention to the question of color as affecting weak or deficient eyesight. He is of opinion that spectacles fitted with yellow glass afford more relief to the patient than the ordinary provided with blue glass. Such spectacles are now sold under the term of "Xanthoscopic," or "Nonactinic." With the curious results of General Pleasonton fresh in our memory as to the stimulating action of blue glass upon animal and vegetable life, the opinions of Dr. Croft possess a considerable amount of probability. It is not unreasonable to assume that there may be two conditions of impaired or deficient eyesight, in the one of which the eyes of the patient may be in a peculiarly irritable condition, and in the other case the eyes may be simply weak and requiring stimulation. In the first of these assumed cases, yellow glass would be the most suitable medium to employ for spectacles, as arresting the blue rays of the spectrum, while in the second case the stimulating action of blue glass might be resorted to with advantage. Much remains to be done in the study of the physiological action of various colored lights, and their effects on health and disease, and a careful investigation would, no doubt, be attended with results which would certainly be of the greatest interest, if not of the greatest practical value.

The Electric Light in Factories.

Mr. William Grosseteste has communicated to the *Soc. Indus. de Mulhouse* the following practical details of the operation of the electric lighting apparatus introduced into a large spinning establishment in France, which are valuable in view of the steadily growing popularity of this form of illumination.

The apartment illuminated has an area of 1314 square meters (14,143 square feet), and is at present illuminated by means of four electrical lamps, which, as compared with the 60 gas-lights formerly required, give more light than is necessary. The lights are placed 3·3 meters above the floor level, and illuminate directly in the usual manner, save that, to diffuse their painful brilliancy, they are surrounded with globes of ground glass. The power to run the lamps is part of that used in the works. The result on the score of amount and character of the light supplied is reported to be quite satisfactory; the workmen preferring it to the gas lights it has supplanted. It was feared that the pillars and other obstructions of the apartment would cause the casting of objectionable shadows; but this difficulty is found to amount to nothing serious, as the disposition of the lamp is such that the rays from each cross that of the others, and the white walls scatter the light so abundantly that the shadows are not objectionable. Tolerably fine print can be read without difficulty at a distance of 40 meters from the nearest lamp. The regularity of the light is quite satisfactory; such variations in intensity as occur occasionally are found to be due entirely to the accidental inferiority of one or more of the carbons, and the difficulty is readily met by exchanging the poor rod for a fresh one.

We are not informed in the communication before us of the amount of candle-power developed, or of power consumed, by actual measurement, for the reason possibly that the item of power in this case happened to be of no special consequence, as they had more than they required. It is to be regretted, however, these data were not ascertained and given with the general account that has been published. In a sanitary point of view, also, the light, in this special case, is highly commended.—*Polytechnic Review.*

The Lowe Gas Process.

Public sale, on Wednesday, July 10, 1878, at 12 o'clock, noon, at the Court House, in the city of Harrisburgh, Pa., the franchises of the corporation called the—

CITIZENS GAS AND GASEOUS FUEL COMPANY,

For which letters patent were issued on the 21st of December, 1875, by the Governor of the Commonwealth of Pennsylvania, under the act of Assembly, approved 29th April, 1874, which charter is recorded in the office of the Recorder of Deeds of Dauphin county, in charter book B, page 138, together with the property of the corporation incident to the exercise of the franchise thereof, viz: A holder, distributing pipes extending under the streets of the city of Harrisburgh, and meters on the premises of consumers and the contents thereof; also, two generators, two superheaters, two wash boxes, two scrubbers, two condensers, one dry scrubber, large oil tank (capacity 250 barrels), locomotive boiler, upright tubular boiler, one engine, two oil pumps, one small oil tank, tools, etc.

Seized and taken in execution and to be sold as the property of the "Citizens' Gas and Gaseous Fuel Company."

JAMES N. KERNS,
U. S. Marshal E. D. of Penna.

U. S. MARSHAL'S OFFICE,
PHILADELPHIA, July 2d, 1878.

Gas-Light Intelligence.

OBITUARY.—We learn of the death, after a short illness, of Mr. Benjamin G. Raymond, Superintendent of the Woonsocket Gas Light Co. In his death the Company lose a faithful and efficient officer, and the New England Association a valuable member.

OUR EXCHANGES.

United States.

[Engineering News.]

GAS WELL.—Alliance, Ohio, is going to sink a gas well.

PROPOSAL TO PURCHASE A GAS WORKS.—The City Council of Xenia, O., proposes to purchase the gas works, if the present proprietors are weary of their stock.

CONTRACT FOR LIGHTING STREETS.—Evansville, Ind. has let a contract for lighting her streets for five years, at $2 per 1000 feet, with a proviso that in case electric light shall come into vogue for street lighting, the contract shall be modified to suit the emergency.

CLOSING A CONTRACT.—The Illinois Coal Gas Co., of Springfield Ill., closed a contract, June 8, to erect works to supply gas for the Union Stock Yards Company, of Chicago.

ORGANIZING A GAS CO.—They are organizing a gas company at Sherbrooke, Quebec, Can., and a township's paper maliciously says that there are several gentlemen in that city acquainted with the manufacture of that article, and who will probably take stock.

REFUSES TO REDUCE THE PRICE OF GAS.—In consequence of the refusal of the Isabella Gas Co. to reduce the price of gas to $2.50 per 1000 feet, the corporate authorities of Frederick, Md., have advertised for proposals from other sources to light the city. The price heretofore paid has been about $3.25 per thousand.

ALLEGHENY, PA., GAS LIGHTING.—The Allegheny Gas Committee met June 7th. Superintendent Falkner, of the Water Works, reported that there are 12 lamps now in the city connected with meters, and the gas company proposes putting in four more. By taking an average of the amount burned in each of these lamps, the average amount burned by each lamp in the city is obtained, and the city is charged accordingly. In order to have the lamps all burn as nearly as possible the same amount of gas, the gas company proposes to put new burners on all the lamps, free of cost to the city. The matter was referred to Mr. Falkner and the chairman. The ordinance granting the National Gas Company the right to lay their pipes in the streets of Allegheny, and to erect buildings, etc., necessary for a gas works, was ordered to be returned to Councils with an affirmative recommendation.

GAS STOCK THAT DIDN'T PAY.—Another speculation of the banker, Harry Beadle, of Elmira, N. Y., was putting $52,000 in what is known as the Bloomfield and Rochester Gas Company. Four hundred worthless shares and 12,100 profitless bonds of this company were found stowed away in an old box. They at one time represented thousands. The Bloomfield Company was a locally engineered enterprise. A natural gas-well years ago was struck at Bloomsfield, about 38 miles from Rochester. Some Elmira Sellerses and Micawbers went to the ground, looked it over, and came to the conclusion that the gas could be utilized. The City of Rochester should be lighted by this natural gas. From Bloomfield it could be brought in pipes, and supplied to citizens of the flour city at one-third the cost of manufactured gas. Over $300,000 in capital was accumulated. Miles of wooden pipe were laid. The gas flowed freely into the pipes, and was conducted easily for miles. Tapped at any point it burned freely. Altogether $800,000 was put into the enterprise. Stockholders refused to sell when they could have realized four times what their original investment had been. At last the bubble burst! The wooden pipes made to carry the gas were cracked open in the ground and the gas escaped in such serious quantities that there was not enough left when Rochester was reached to light up a lantern! And then it was found, after a partially successful attempt was made to close up the cracks in the pipes, that the natural gas could not be made available for illuminating purposes unless it was mixed with a proportion of manufactured gas.

[Mining and Scientific Press.]

NEW APPARATUS FOR A GAS WORKS.—We learn that the Reno Gas Works are being provided with flue condensers, lime purifiers and station meters, under contract with the well known Gas Engineer, James R. Smedberg, who has already erected a setting of wood gas retorts, and one of his exquisite Pelouze and Audoin condensers at the same station. This late move completes the change from oil to wood, and will win a gas of very high purity and candle power from the pitch pine of the Sierra Nevada without any admixture of Australian shale to enrich. It is anticipated that 25,000 cubic feet of purified gas will be obtained from a cord of this wood, but we are promised the actual result for publication in an early number.

On Some Candles Altered by Long Exposure to Sea-Water.

BY J. H. GLADSTONE, PH.D. F.R.S., PRES. C S.

I am indebted to Mr. Latimar Clark for some specimens of candles which are stated to have been recovered from the wreck of a Dutch vessel, sunk in Vigo Bay during the war in the year 1702. As the vessel was supposed to be a treasure ship many attempts have been made to recover its contents, and this was successfully accomplished in 1875, when these candles, among other things, were obtained. They have therefore been submerged 173 years.

The wick has rotted away, leaving scarcely any trace of its existence, while the fatty portion has become a friable heavy substance, of a dull white color. The candles bore evidence of having been made by dipping, for the concentric layers were easily separated from one another, and this facilitated the examination of the outer and inner portion of the same piece.

Both the outer and inner portions still contain some of the fat apparently unchanged; they are unctuous to the touch, and have a fatty odor, and when heated to a little below 110° C. they began to change color; at 140° they softened, and at 200° small portions were melted out. This easily fusible matter dissolved readily in ether, and was almost white. Indeed the fat can be easily separated from the rest by treating the altered candles with ether and benzene, and in one experiment, made on 2 grms. of the candle, 0·879 grm. of fat, or 44 per cent. of the whole, was thus dissolved out.

Pieces exposed to the heat of a lamp flame gave off combustible vapors, as might be expected, with the usual smell of burnt fat.

After complete combustion there remained a strongly alkaline white ash, consisting of carbonate and chloride of calcium and sodium, with traces of magnesium and potassium: The outer layers of one of the pieces, weighing 2·035 grms. yielded 0·147 of ash, or 7·2 per cent The inner layers, weighing 2:262 grms., yielded 0·1997 grm., or 8·4 per cent. The chlorine in the first portion was estimated at 0·0266, and in the second at 0·0233; if this existed wholly as chloride of sodium it would indicate 2.15 and 1·70 per cent. respectively; but as sea-water usually contains about 2·8 per cent of this salt, and the porous candles were no doubt saturated with sea-water, and allowed to dry in that condition, the chloride of sodium may be regarded as extraneous. The amount of calcium in the outer layers was found to be 0.053, and in the inner 0·0821; if this existed wholly as stearate of calcium ($C_{36}H_{70}CaO_4$) these figures would indicate 39·5 and 55 per cent respectively, but there seems also to have been present a certain amount of stearate of sodium. The excess of sodium in the inner portion beyond what was necessary to saturate the chlorine amounted to about 0·0098, indicating at least 5·76 per cent of stearate.

It thus appears that the fat has been converted in a great measure into calcium and sodium salts, doubtless by the slow replacement of the triatomic group C_3H_5 in the stearine by 3 atoms of the metal, with the simultaneous production of glycerine.

Though the calcium in sea-water is far less abundant than the sodium, it appears to have had a much greater effect; but it is of course, impossible to say whether the one salt has not been made by double decomposition from the other.

The most interesting point, as it appears to me, is that whereas the fats have been in contact with a practically unlimited amount of sea-water for 173 years, and a chemical change between them has been possible, the double decomposition has proceeded so slowly that the reaction is only about half completed at the present time.—*Chemical News.*

Gas—Gas—Gas.

And now comes Peoria, also, and by the *Journal* of that city we are enlightened as follows:

"The gas conspirators have held up Flannery to the outside public as the man who, in company with Frost & Co., was about to establish gas works here. This is their pretense before the public. In their secret councils they regarded Flannery as a patent right peddler, only waiting an opportunity to sell them out and skip. Each one, it seems, is nervous, watching the rest and waiting his own chance to get even. They came before the public yelling for free competition, and then went to the council and told them that the contract to light the city isn't worth a rush unless they can have the exclusive contract. They pretended to want a fair show, but what they did want was to build up as big a monopoly as the one of which they complained.

"To give our readers an idea of how honest these chaps are, we will state the following: One of them approached a member of the gas company, early in the beginning of this fight, and said "I'll tell you how we can make some money. I'll pitch into the old company. I'll get permission from the council to sue them for damages, and I'll draw up a bill of particulars as long as from Davis's corner to the court house. Then I'll call public meetings, and denounce them, and get the city contract. The foreign stockholders will get scared. The stock will run down. You buy it up, and we'll divide.' This proposition was made to a member of the gas company. How well it has been carried out, the history of this gas fight shows. The whole animus of the contest shows that it hasbeen an attempt by a lot of unscrupulous men to steal the property of the gas company, and to overawe the public by villifying and traducing every man who did not lend his countenance to the scheme. This is all there ever was to it, and this is why, when brought face to face with the contract, there has always been a square back-down."

We think in time it will gradually creep through the minds of our own alleged fathers that the new gas company here started out to levy upon the old company, and not to furnish cheap gas, and that they have succeeded by the aid of the Council in doing just what they started out to do, and having obtained one contribution by a forced purchase of a part of their stock, they now come back and ask, by mean of the suit, to force another contribution.—*Indianapolis Journal*, July 9th, 1878.

[From "Journal of Gas Lighting."]

Analysis of Australian Shale.

In the early part of last year we recorded the arrival in the London Docks of a cargo of "Hartley mineral" or Australian Boghead. Our readers will be pleased to see a report as to the quality of this mineral, by an able officer of The Gaslight and Coke Company, with which we have been favored by the importers, with permission to publish the same:

"The Gaslight and Coke Co., March 3, 1877.

Analysis and Report on Australian Shale received by Messrs. W. Mort & Co., 155 Fenchurch Street, ex "Martin Luther," January, 1877.

Dear Sirs: According to your instructions, I have pleasure in forwarding you my report on this coal. It has been carefully tested, and a series of analyses made experimentally, and the following results have been obtained:

CHEMICAL ANALYSIS.

Volatile matter	70	per cent.
Coke (Carbon	8	"
Coke (Ash	22	"
	100	"
Purified gas per ton of shale	15,399	cubic feet.
Illuminating power (stand'd test)	46·35	sp. candles.
Hydrocarbons condensable by bromine	24·05	per cent.
Sulphuretted hydrogen in foul gas	0·5	"
Carbonic acid in foul gas	1·7	"
Ash in coal	22·0	"
" coke	74·5	"
Sulphur in coal	0·49	"
Tar per ton of shale	40	gallons.
Liquor per ton (4 oz. strength)	24	"
Coke and breeze per ton	4¼	per cent.
Specific gravity	10·60	"

The illuminating power ranged from 38·46 to 48·32 sperm candles. This is a remarkably rich cannel coal; it yields a large amount of gas of high illuminting power. (Signed) ALFRED KITT.

Sir: In yoar last number I observe an analysis of "Hartley Mineral," or Australian Boghead, made by Mr. Alfred Kitt.

Your readers may be interested in the following analysis, which I made of this mineral in January, 1866, especially as I have reason to believe that it was the earliest examination made in this country;

Specific gravity	1·196	
Ash	35·89	per cent.
Coke per ton	770	lbs.
Purified gas per ton	12,500	cubic feet.
Crude gas contained—		
Sulphuretted hydrogen	0·8	per cent.
Carbonic acid	1·1	per cent.
Purified gas contained		
Matter condensed by bromine	32·2	per cent.
Illuminating power of gas	44·21	sp. candles.

WILLIAM KING.

Liverpool Gas Co., March 1, 1878.

Possible Use for a Constituent of Gas-Lime.

BY THOMAS DOUGLAS.

The following experiment was made some months since to find if the sulpho-cyanates, usually found in some quantity in gas-lime, could be readily transformed into ferro-cyanides. It is an established reaction that potassium sulpho-cyanate and iron filings heated together yield potassium ferro-cyanide and the sulphides of potassium and iron. I wished to determine if a crude sulpho-cyanate extracted from gas-lime would give a ferro-cyanide with the same treatment.

Some gas-lims was mixed with about five per cen of soda ash, extracted with water, and the solutiont evaporated to dryness. The dry extract was mixed with iron filings in a mortar, then heated in a small covered clay crucible for a short time over a Bunsen lamp. The residue, boiled with water and acidified with hyd.ochloric acid, gave an abundant precipitate of Prussian blue with ferric chloride.

I have not time, and it is rather out of my way, to experiment further on this subject at present, It was called to mind by the report of Mr. Mayer's paper on "Hislop's Process for the Regeneration of Gas-Lime," in a recent issue of the CHEMICAL NEWS (vol. xxxvii. page 89). If the above process for obtaining ferrocyanides from gas lime should prove of any commercial value it would be a ready method of getting rid of at least part of the sulphur compounds in gas-lime, Alkaline sulpho-cyanates are very soluble in water, and a strong solution would be obtained by passing the same liquor through successive fresh portions of gas-lime until saturated.—*Chemical News.*

Detection of Ozone in the Air.—M. G. Daremberg.—The author finds that in his observations, ozonoscopic papers were little affected at the coast line, whilst at the distance of 30 metres, the impression was much stronger. The action increases with the wind.—*Chem. News.*

The Telephone.—M. Izarn.—The author having set up a telephore, the wire of which is connected with two gas-burners, finds that it transmits very distinctly the signals traversing two telegraphic systems not merely absolutely distinct from his wire but at a considerable distance.—*Chem. News.*

Prices of Gas Coal.

Waverly Youghiogheny	5.25	
Moore's "	5.50	
Shafton	5.35	
Despard Marion	5.15	
Newburgh Orrel	@	3.85 at Baltimore.
Murphy Run	5.25	
Chesapeake and Ohio Agency Coal	5.25	4.00 at Richmond.
Newcastle	3.75 @ 3.85	
Provincial	4.15 @ 4.50	
Cannelton Cannel	10.00	
Ince Hall	8.00	

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.

(with W B Scott & Co.,)

24 PINE STREET, NEW YORK CITY.

JULY 2, 1878

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share. ☜

11 sh. of Peoples of J. C. sold at auction @ 106.

The Nassau Gas Co. of Brooklyn have declared a dividend of 3 %, payable July 15th at their office.

The Citizens Gas Co. of Brooklyn have declarsd a dividend of 3 %, payable July 15th at their office.

The Williamsburgh Gas Co. have declared their regular quarterly dividend of 1½%, payable July 15th at their office.

The Mutual Gas Co. of New York declared a dividend of 1½%, and paid it on July 10th

Gas. Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked.*
Central, Westchester	466,000	50	—	80
Harlem	$1,850,000	50	85	88
Manhattan	4,000,000	50	185	190
Metropolitan	2,500,000	100	132	135
" Scrip	$1,000,000	..	100	103
Mutual	5,000,000	100	74	78
" Bonds, gold.	900,000	1000	—	105
Municipal	1,000,000	100	95	100
New York	4,000,000	100	95	98
Suburban, W'steh'str	390,000	50	—	100
Gas Co.'s of Brooklyn.				
Brooklyn	2,000,000	25	130	140
Citizens	1,200,000	20	70	—
" Scrip	320,000	1000	95	97½
Peoples	1,000,000	10	10	20
" Bonds	$ 325,000	...	...	95
" Scrip	300,000	...	75	80
Metropolitan	1,000,000	100	—	65
Nassau	1,000,000	25	--	78
" Ctfs.	700,000	1000	96	98
Williamsburgh	1,000,000	50	75	81
" Scrip		...	95	97
Kings Co	200,000	100	80	90
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	80	90
Out of Town Gas Companies.				
Bath, Maine	70,000	100		
Buffalo Mutual, N. Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md	2,000,000	100	134	134
" Ctfs., gold	1,000,000		106	110
Bayonne, N. J		100		90
Brockport, N. Y	25,000	100	...	80
Citizens, Newark	918,000	50	109	110
Chicago Gas Co., Ills			150	
" " Bds.	124,000	—	105	107
Cincinnati G & C Co				190
Derby of Conn	160,000	100	60	80
East Boston, Mass.		25	132	--
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind		100	...	—
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	184	186
Hempstead, L I	25,000	100	...	—
Jersey City	386,000	20	155	160
Jamaica, L. I	25,000	100	...	—
Jacksonville, Ill	120,000	50	82	...
Lewistown Maine	400,000	100	70	80
Lima, Ohio,	60,000	100	—	...
Bonds	30,000		90	
Laclede St Louis Mo.	1,200,000	100	100	110
Long Branch		20	40	50
New Haven, Conn		25	160	—
Peoples, Jersey City		...	110	118
Peoples of Albany	650,000	100	10	17
" Bonds	350,000	1000	--	-
Peoples of Baltimore		25	51	52
" Bonds			106	—
Plainfield, N J	80,000	100	—	105
Perth Amboy		25	—	95
Rochester, N. Y		100	50	60
Woonsocket, R. I	150,000	100	95	...
Halifax N. S	400,000	40	148	150
Hamilton, Ontario	150,000	40	117½	
San Francisco Gas-Co., S. Fr'isco Cal.			93	94
St. Louis, Missouri	600,000	50	73	75
Stillwater, Minn	50,000	50	—	26
Saugerties, N. Y	15,000	100	95	100
Troy, Citizens	600,000	100	—	60
Toledo, Ohio			95	97
Washington, D. C		20	230	240

Advertisers Index.

GAS ENGINEERS.

	Page.
William Farmer, New York City	40
James H. Walker and Son, Milwaukee, Wis	40
George W. Dresser, New York City	40

GAS WORKS APPARATUS AND CONSTRUCTION.

Herring & Floyd, New York City	43
T. F. Rowland, Greenpoint, L. I	43
J. W. Starr & Son, Camden, N. J	43
Delly & Fowler Philadelphia, Pa	43
Kerr Murray, Fort Wayne, Ind	42
George Stacey & Co., Cincinnati, Ohio	43
Brown & Owen, Philadelphia, Pa	43
Mackenzie & Sayre Man'f'g Co	43

GAS AND WATER PIPES.

McNeals & Archer, Burlington, N. J	42
Gloucester Iron Works, Philadelphia, Pa	42
Robt. Campbell & Co., New York City	42
James Marshall & Co Pittsburgh, Pa	42
R. D. Wood & Co., Philadelphia, Pa	42
S. Decatur Smith, Philadelphia, Pa	42
H. R. Smith & Co., Columbus, Ohio	4

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William Smith, Pittsburgh Pa..... 42
B. S. Benson, Baltimore, Md..... 42
Warren Foundry and Machine Co..... 42

PIPE CUTTING MACHINES.

A. C. Wood, Syracuse, N. Y. 45

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J..... 44
B. Kreischer & Sons, New York City..... 45
Adam Weber, New York City..... 44
Gardner Brothers, Pittsburgh Pa..... 44
Laclede Fire Brick Works, St. Louis, Mo..... 44
Brooklyn Retort and Fire Brick Works..... 44
Borgner & Obrien, Phila, Pa..... 45
Evens & Howard, St. Louis, Mo..... 45

GAS METERS.

Harris, Griffin & Co., Philadelphia, Pa..... 46
American Meter Co., Philadelphia, Pa 47
W. W. Goodwin & Co., Philadelphia, Pa..... 47
Harris, Heime & McIlhenny, Philadelphia, Pa..... 47

VALVES.

Charman Valve Manufacturing Co., Boston, Mass..... 48
Ludlow Valve Manufacturing Co., Troy, N. Y..... 45

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind.. 44
Smith & Sayre Manufacturing Co., New York City..... 46

GAS COALS.

Penn Gas Coal Co., Philadelphia, Pa..... 4.
Provincial Gas Coals, Perkins & Job, N. Y & Boston 41
Cannelton Coal Co., " " " " 41
New York & Cleveland Gas Coal Co., Pittsburgh, Pa.... 41
Newburgh Orrel Coal Co., Baltimore, Md..... 41
Despard Coal Co., Baltimore, Md..... 41
Tyrconnell Coal Co., Baltimore, Md..... 41
Fort Pitt Gas Coals..... 41
Chesapeake & Ohio R. R. Coal Agency..... 41

GAS SCREENS.

Jas. P. Mahan, Boston, Mass..... 39

BURNERS.

C. H. Meyer & Co., Philadelphia, Pa. 46
C. Gefrorer, Philadelphia, Pa..... 40

PROCESSES.

Gwynne Harris, New York City..... 43
Lowe, Philadelphia, Pa. 46

GAS FIXTURES.

Mitchell, Vance & Co., New York City..... 16

GAS STOVES.

Retort Gas Stove Company..... 39

CEMENT.

S. L. Merchant & Co., New York City..... 47

LAMPS.

J. G. Miner..... 40

BOOKS.

Cathels, Gas Consumer's Manual..... 47
How to Burn Gas..... 39
Scientific Books..... 46
Fodell's Book-Keeping..... 47

GAS MACHINES.

Walworth Manufacturing Co. Boston, Mass..... 47
Springfield Gas Machine Co., New York City..... 47

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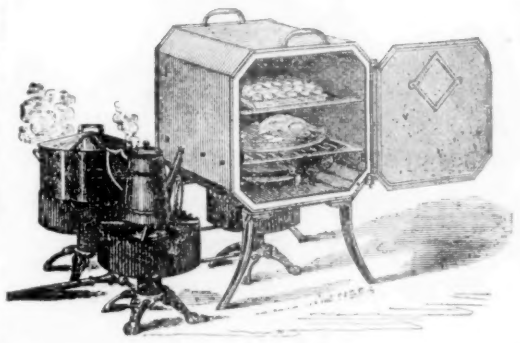

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the management of a medium sized Works. Served many years in the largest Works in England, and seven years in this country as Superintendent. Sets his own Retorts, lays his own Mains, and does most of the responsible part of the work himself, and thoroughly understands the whole of its branches. Reason for changing present works—too small. Can be well recommended.

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A MAN THIRTY YEARS OF AGE, WISHES A SITUATION AS

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in a Gas Works. Has had experience in Gas Works, and in different manufactories. Can give the best of references as to ability and character. Is not particular as to what part of the States he may be located in. Any one desiring such a party will please address H. GREEN,
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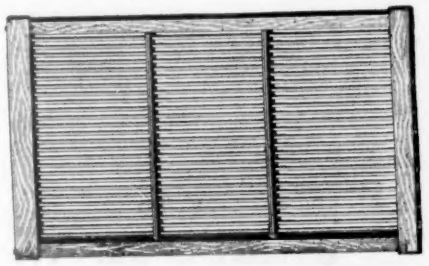

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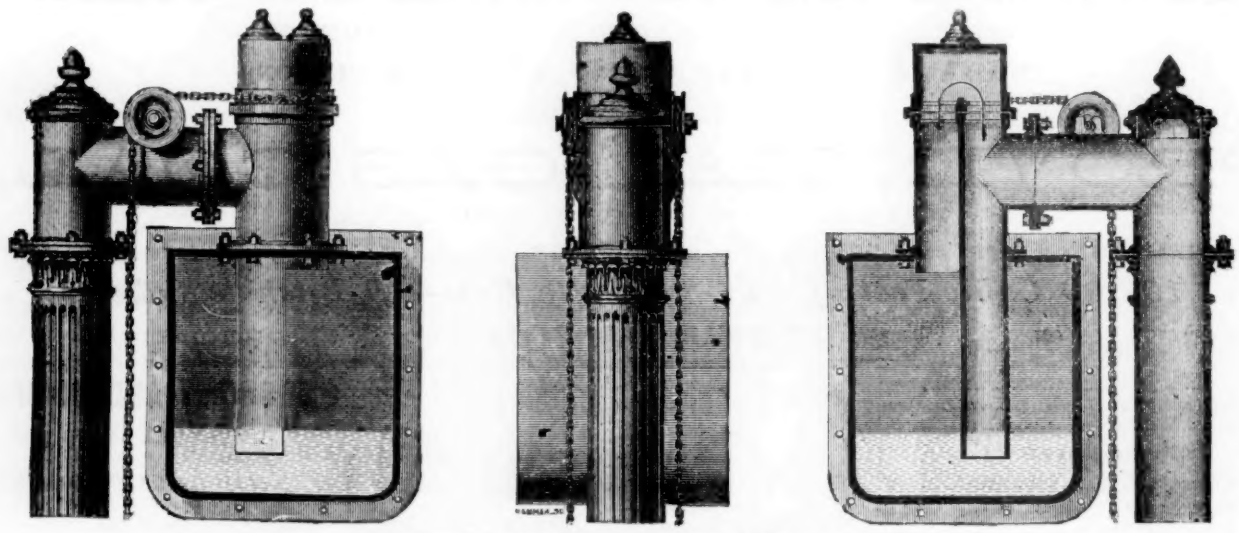

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To Gas Light Companies throughout the country.
Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, } Baltimore.
Company's Office, 15 German St., }

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine
*** Reference to them is requested. 204-1

TYRCONNELL GAS COAL.,
MINED IN TAYLOR COUNTY, WEST VA.
Company's Office, 52 S. Gay St., Baltimore.
CHARLES MACKALL, Secretary.
CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.
SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas with an illuminating power of over 16 candles. Forty bushels of very superio Coke, with little Ash and scarcely any clinker 04-1y

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FORT PITT GAS COAL

This Company is prepared to supply any amount of their
Celebrated Gas Coal
to all points reached by rail or lake throughout the West.
THE FORT PITT COAL COMPANY,
OFFICE, 337 LIBERTY STREET,
434-1y PITTSBURGH PA.

GAS COALS.

THE
PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station, on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES
No. 11 Merchants Exchange, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.
Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL COMPANY
OF WEST VIRGINIA.

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County West Virginia delivered at RICHMOND, Va.:

CANNELTON CANNEL,

acknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,00 cubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

CANNELTON CAKING COAL.

MAXIMUM YIELD, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb —gave 16 14-100 Candle-Power.
COKE, of very fine quality—1453 pounds produced from one ton of coal.

SALES AGENTS { J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.
PERKINS & JOB, 45 South Street, N. Y.; 91 State Street, Boston.
H. W. BENEDICT & SON, New Haven.

PROVINCIAL GAS COALS.

The undersigned are prepared to execute orders for the

BLOCK HOUSE,
INTERNATIONAL, GLACE BAY,
CALEDONIA, and LINGAN COALS.

For delivery at any Port in the United States.

PERKINS & JOB,

91 STATE STREET, BOSTON. 45 SOUTH STREET, NEW YORK

CHESAPEAKE AND OHIO RAILROAD
COAL AGENCY.

FOR THE SALE OF THE SUPERIOR

KANAWHA GAS COALS,

ALSO,

CANNEL,
SPLINT,
and STEAM COALS.

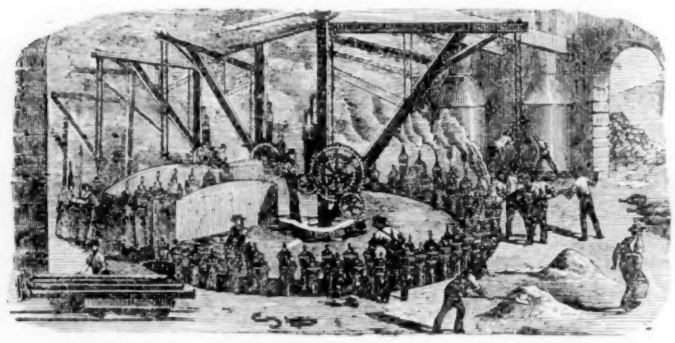
From the Kanawha and New River Regions, on the Line of the Chesapeake and Ohio Rail'r

C. B. ORCUTT, Secretary. } OFFICE No. 7 WALL ST.
J. J. GORDON, Sales Agent. } NEW YORK.

M'NEALS & ARCHER,

BURLINGTON. N. J,

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.

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BENJAMIN CHEW, Treasurer,

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GLOUCESTER IRON WORKS,

GLOUCESTER CITY N. J.

CastIron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gas Holders, &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N, J.
NEW YORK OFFICE, 153 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc. 436-1

H. R. SMITH & CO.,

COLUMBUS, OHIO,

MANUFACTURERS OF

CAST IRON GAS & WATER PIPE,

BRANCH CASTINGS, LAMP POSTS, Etc.

(Pipe from three inch and upwards cast *vertically* in 12 feet lengths.)

HEAVY AND LIGHT CASTINGS OF ALL KINDS.

DAILY CAPACITY 125 TONS.

Our Works *connect direct* with *eleven railroads* centering in this city, giving us unequalled facilities for shipping to all points, at the lowest rates.

NATIONAL FOUNDRY

AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, IKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

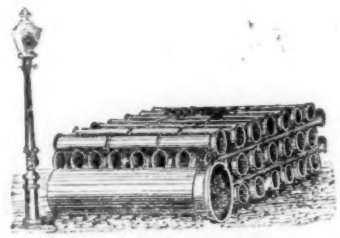
WM. SMITH.

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, and all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N. B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.

☞ SEND FOR CIRCULAR AND PRICE LIST. ☜



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FOR GAS AND WATER

Lamp Posts, Valves, Etc.

Mathew's Pat. Anti-Freezing Hydrants,

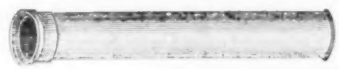
400 Chestnut Street.

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES,



Works, 18th, 19th, 20th and Railroad Street.
Office, No. 23 Nineteenth Street.

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N.B.—Pipes from 3-inch and upwards cast in 12 ft. lengths.

☞ Send for Circular and Price List.

BERGEN IRON WORKS.

ROBT. CAMPBELL & CO.

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,

Valves, Fire and Dock Hydrants,
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Bench Castings for Gas Works, &c.

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MANUFACTURER OF

Cast Iron Pipes and Fittings

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Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

Office & Factory 52 East Monument St.,

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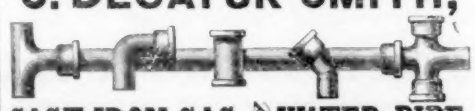

CAST IRON GAS and WATER PIPE,

Foundry, Cor. of York and Moyer Streets,

PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS ☜

MURRAY & BAKER,

Practical Builders,

And Contractors for the Erection of Gas Works,

MANUFACTURERS OF ALL THE LATEST AND MOST IMPROVED APPARATUS AND TOOLS FOR THE MANUFACTURE & DISTRIBUTION OF COAL GAS.

☞ WORKS AT THE RAILWAY DEPOTS,

FORT WAYNE, INDIANA.

We manufacture Bench Castings, Washers, "The Immersed Multitubular," and Atmospheric Condensers, Wet and Dry-Lime Purifiers, Dry Center Seals, Telescopic and Single Gas Holders, Wrought Iron Trussed Roof for Iron or Slate, Wood and Iron Trays for Purifiers, Coke and Coal Carts, Wrought Iron Screening Shovels and Castings, and Wrought Work of every description for Gas-Works.

As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones

The most satisfactory references can be given, if required of the experience and commercial fairness which characterizes our dealings.

We would respectfully invite Western men to call and see our patterns and works here. MURRAY & BAKER,
Fort Wayne, Indiana

GEO. STACEY. HENRY RANSHAW WM. STACEY

GEO. STACEY & CO.

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS,

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39.
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MANUFACTURERS OF

EVERY DESCRIPTION OF

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Particular attention given to the alterations of old works

Estimates and Drawings furnished.

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MANUFACTURERS OF

ALL KINDS OF CASTINGS

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APPARATUS FOR GAS-WORKS.

BENCH CASTINGS

from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS: CONDENSERS; SCRUBBERS,

wet and dry), and

EXHAUSTERS

for relieving Retorts from pressure.

BENDS and BRANCHES

of all sizes and description.

FLOYD'S PATENT

MALLEABLE RETORT LID.

SABBATON'S PATENT

FURNACE DOOR AND FRAME.

SELLER'S CEMENT

for stopping leaks in Retorts.

GAS GOVERNORS,

and everything connected with well regulated Gas Works, at low price, and in complete order.

N. B.—**STOP VALVES** from three to thirty inches—very low prices.

SILAS C. HERRING. JAMES R. FLOYD.

NATIONAL COAL GAS COMPANY.

320 Broadway, N. Y., Rooms 50, 51 & 52.

Elevator on Pearl Street.

H. P. ALLEN, President.

The process known as GWYNNE-HARRIS but from later most essential improvements, more appropriately called the ALLEN-HARRIS, or AMERICAN HYDROCARBON process for making "Water Gas," by the decomposition of superheated steam, in fire-clay retorts, set similarly to those in Coal Gas Works, is an established success. More than One Hundred Million cubic feet of gas have been made under this process, and for *permanency* and *brilliancy*, as well as economy both to the manufacturer and consumer, it is superior to any gas made by the old, or any other method.

Our process is *not intermittent* but continuous. The steam and the oil are admitted into the retorts by gauge cocks, and run for days without change. All the materials required, besides the steam, are 17 lbs. of Anthracite coal and about 3½ gallons of Petroleum or Naphtha, per 1000 feet of brilliant gas.

Rights for sale. Inquire of the President.

1842. **DEILY & FOWLER** 1878.

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET,

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MANUFACTURERS OF

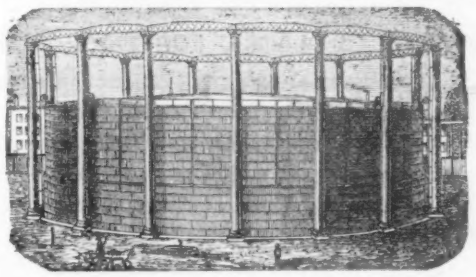
GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. Previous to 1868 our Mr. D. built *nine Gas Works* and *fifty-four Holders*. Since that date we have built *three Gas Works* and *forty-six Holders*. We *superintend in person* the erection of all our work, and would refer to the Gas Companies at the following places, where we have built Holders since 1868:

Lancaster, Pa.	Barnesville, O.
Williamsport, Pa.	Franklin, Ind
Bristol, Pa.	Jacksonville, Ill. (2)
Catasaqua, Pa.	Joliet, Ill.
Kittanning, Pa.	Lawrence, Kansas.
Hazelton, Pa.]	Jefferson City, N. O., La.
Freeport. Pa.	Algiers, N. O., La.
Huntingdon, Pa.	Kalamazoo, Mich.
Pittston, Pa.	Buffalo, N. Y.
Bethlehem S). Pa.	Ogdensburg, N. Y.
Sharon, Pa.	Waverly, N. Y.
Canton, Pa.	Little Falls, N. Y.
Annapolis, Md.	Penn Yann, N. Y.
Parkersburg, Wes.	Watkins, N. Y.
Lynchburg, Va.	Gloucester, N. J.
Youngstown, O	Salem, N. J.
Steubenville, O.	Mount Holly, N. J.
Zanesville, O.	Plainfield, N. J.
Mansfield, O.	Englewood, N. J.
Marion, O.	Dover, Del.
Bellevaire, O.	Pittsfield, Mass.
Athens, O.	Meriden Conn-

CONTINENTAL WORKS.



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T. F. ROWLAND, Proprietor,

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ENGINEER AND MANUFACTURER OF

GAS-HOLDERS.

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities. Towns, Mansions, and Manufactories.

MACKENZIE & SAYRE MAN'F'G CO.,

141 BROADWAY, NEW YORK.

Gas Works, Smelting Works & Machinery.

Proprietors of P. W. MACKENZIES PROCESS AND APPARATUS for making Illuminating Gas from Ordinary Gas Coals, enriched with Cannel or Oil. Also, Mackenzies Process for Making Heating Gas for Smelting, Melting, Puddling, Forges, Boilers, Etc. Also,

P. W. Mackenzie's New Engine and Boiler.

434—1y

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames,

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

GAS HOLDERS,

TELESCOPIC AND SINGLE

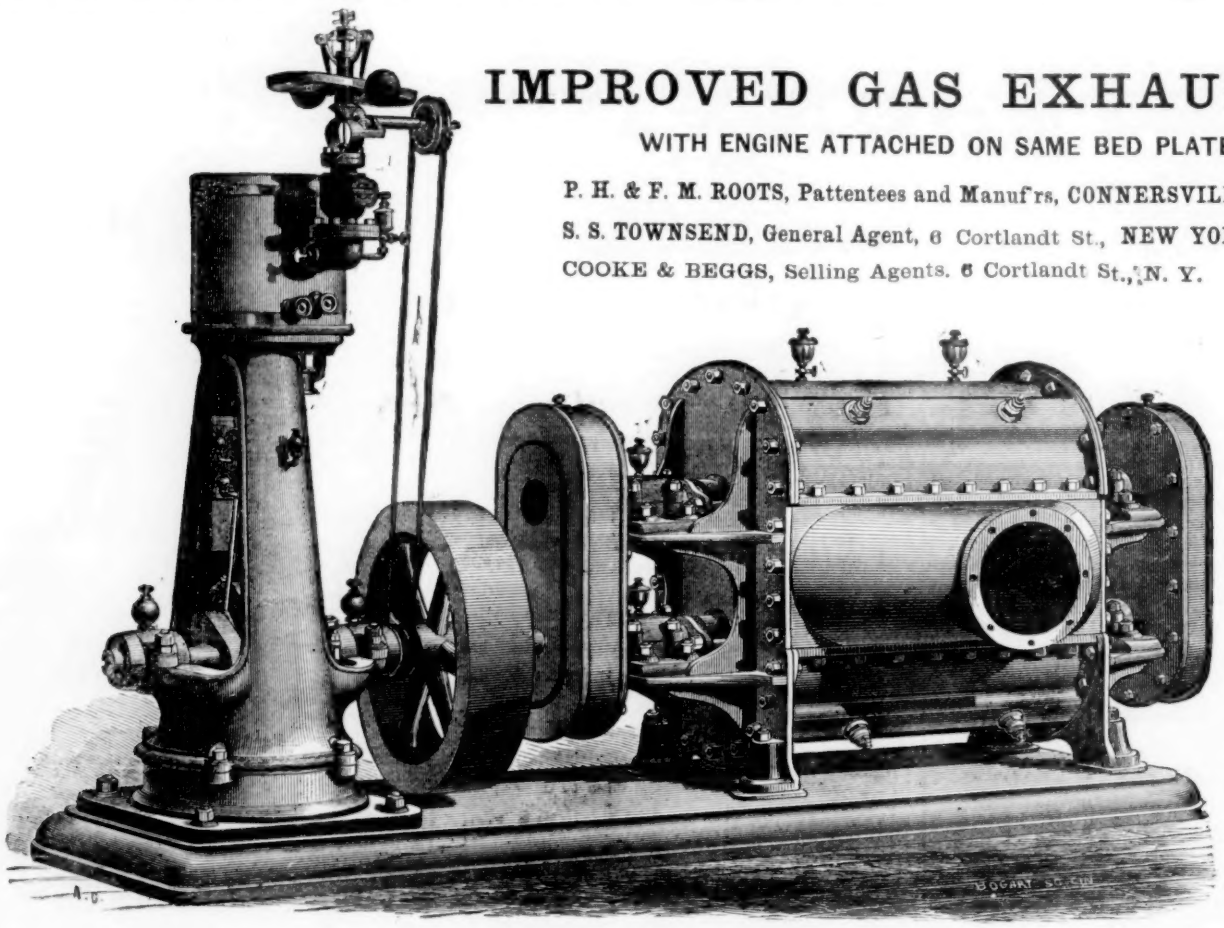
With cast iron guide and suspension frames. GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 226-tf

JESSE W. STARR. JESSE W. STARR, JR.



IMPROVED GAS EXHAUSTER,

WITH ENGINE ATTACHED ON SAME BED PLATE.

P. H. & F. M. ROOTS, Pattentees and Manufrs, CONNERSVILLE, IND.

S. S. TOWNSEND, General Agent, 6 Cortlandt St., NEW YORK

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ADVANTAGES CLAIMED FOR THIS EXHAUSTER.

1. It is simpler than any other Exhauster. The internal operating parts consist of only two pieces, cast entire, and can not get out of order.
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4. They are built in the most complete and substantial manner, and of any required size, with steel shafts and improved journal bearings.
5. We furnish Exhausters and Engines combined on same Bed Plate, as shown above, or the Exhauster only, as may be required.
6. We also furnish Bye Passes and Gas Valves on improved plans, also Exhauster Governors and Elbows, Pipes, Drawings, etc.

Send for Illustrated Catalogue, giving details of capacity, speed, power required, price, and references to parties using them.

P. H. & F. M. ROOTS.

J. H. CAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

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MANUFACTURERS OF

Clay Gas Retorts,

Gas House Tiles,

Fire Bricks, Etc. Etc.

Ground Clay, Fire Brick and Fire Sand in Barrels,

ALWAYS ON HAND.

J. H. GAUTIER.
C. E. GREGORY

393-1y

Brooklyn Clay Retort

AND

FIRE-BRICK WORKS.

Manufacturers of Clay Retorts, Fire Bricks, Gas House and other Tile, Cupola Brick, etc. Dealers in and Miners of Fire Clay and Fire Sand. Clay bank at Burt's Creek, New Jersey. Manufactory: Van Dyke, Elizabeth, Richards and Partition Streets, Brooklyn, N. Y. Office, No, 88 Van Dyke Street.

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FIRE BRICKS AND

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Hand and Machine made Retorts and Settings, Superior Fire Bricks for Siemans Gas and Glass Furnace. Bricks and Tiles for Whitwell's Hot Blast Ovens, Blast Furnace and Cupola Tiles, Etc.

Fire Bricks and Tiles

of all shapes and sizes.

Glass Pot Clay. Fine Ground Clay and Fire Bricks. Sewer Pipe, Etc.

901 Pine Street, St. Louis, Mo.

642—

MANHATTAN

FIRE BRICK & ENAMELLED CLAY

RETORT WORKS.

ADAM WEBER,

(Successor to MAURER & WEBER.)

PROPRIETOR.

Office and Works, 15th Street, Avenue C

Manufactures of

FIRE BRICK AND TILES,

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

☞ Articles of every description made to order at short notice. 1)5

Works: LOCKPORT, PA.

Established 1864.

Works: MT. SAVAGE JUNCTION, MD.

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Manufacturers of Clay Gas Retorts and Retort Settings,

"STANDARD SAVAGE"

Fire Brick, Tile and Furnace Blocks,

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MINERS AND SHIPPERS OF FIRE CLAY.

Sole Agent for New England, C. H. SPRAGUE, 86 State Street, Boston.

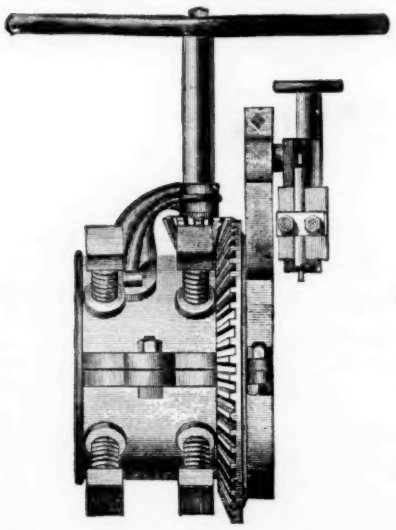
OFFICE: No. 376 PENN AV'E., PITTSBURGH, PA.

A. C. WOOD'S
CAST IRON PIPE CUTTER

PATENTED MAY 23rd, 1876.

PRICES REDUCED TO MEET THE TIMES.

We have been able to reduce the cost of Manufacturing, and desire to give our Customers the benefit at the following



REDUCED RATES:

No. 1 cuts 3, 4 and 6 inch Pipe $75
No. 1 1-2 cuts 4, 6 and 8 in. Pipe, $85
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No. 3 cuts 16, 18 and 20 in. Pipe, $225
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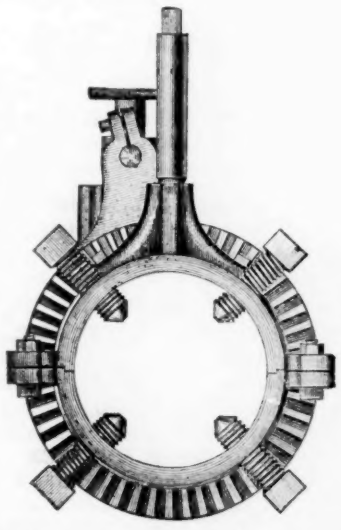
No. 5 cuts 36 inch Pipe, $350

For larger sizes Special Contracts will be made.



It will cut a Continuous Line of Pipe in a Trench or Building

As well as loose Cast or Wrought Iron Pipe, Shafts or Columns of any size, leaving the ends clean, smooth, and square.

Our Machines for cutting 20 and 30-INCH PIPE have been furnished the Manhattan and New York Gas Light Companies; also for cutting 12, 20, and 36 inch Pipe to the Boston Gas-Light Company. The smaller sized Machines have been in practical use in various parts of the country by Water and Gas Compani for over two years, and all with the most satisfactory results. Address

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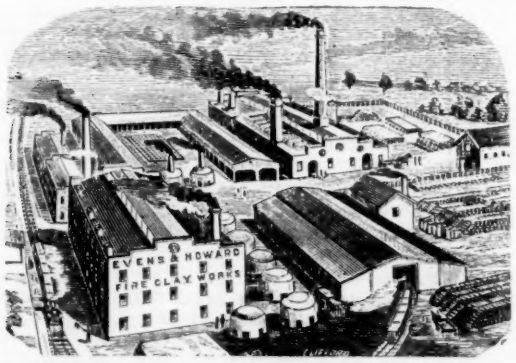
BROWN & OWEN, 20th and Filbert Sts., Philadelphia.
MORRIS, TASKER & CO., 36 Oliver Street, Boston, Mass,

EVENS & HOWARD,



GAS RETORTS,
FIRE BRICK,
Retort Fittings,
FURNACE & CUPOLA LININGS
OF EVERY DESCRIPTION.
Sewer Pipe and Drain Tile.
FINEST QUALITY GLASS HOUSE POT CLAY A SPECIALTY.
916 MARKET STREET. ST. LOUIS.

THROUGH CARS LOADED AT FACTORY FOR ALL ACCESSIBLE POINTS,

LUDLOW
Valve Manf'g Co.,

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938 to 954 River Street and 67 to 83 Vail Ave.
TROY, NEW YORK.

BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ½ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—
HYDRAULIC MAIN DIP REGULATORS.
ALSO
FIRE HYDRANTS.

REFERENCES FURNISHED.
SEND FOR CIRCULARS.

Established in 1845.

B. KREISCHER & SONS,

Office Foot of Houston Street, E. R., N. Y.

GAS RETORTS, TILES and FIRE BRICK

Of all Shapes and Sizes.

FIRE MORTAR, CLAY and SAND.

ARTICLES OF EVERY DESCRIPTION MADE TO ORDER AT THE SHORTEST NOTICE.

BORGNER & O'BRIEN,

MANUFACTURERS OF

Clay Gas Retorts and Retort Settings, Fire Bricks, Tiles, Etc.

TWENTY-THIRD STREET BELOW VINE—PHILADELPHIA.

18 Years Practical Experience. GAS HOUSE WORKS a Specialty 448

INTERNATIONAL--1876--EXHIBITION.

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HAVE DECREED AN AWARD TO

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12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S. A.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

GROUP JUDGES.

AMERICAN.

PROF. JOSEPH HENRY, LL.D., Secretary of Smithsonian Institution, Washington, D. C.
PROF. F. A. P. BARNARD, S.T.D., LL.D., President of Columbia College, N. Y.
PROF. J. E. HILGARD, Washington, D. C.
PROF. J. C. WATSON, Ann Arbor, Michigan.
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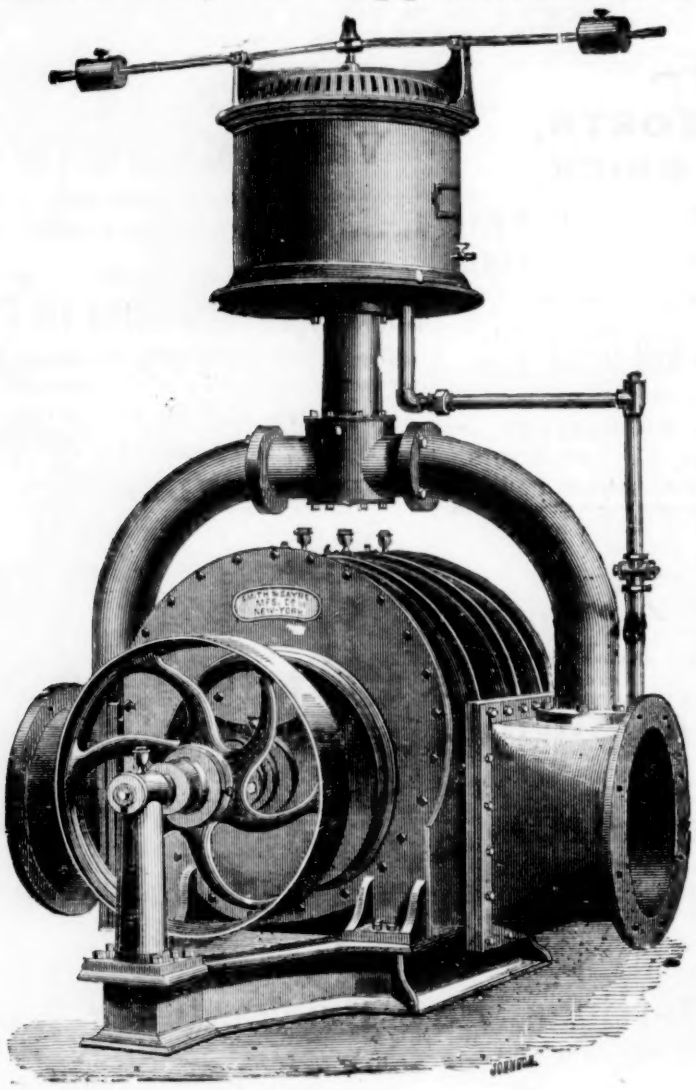

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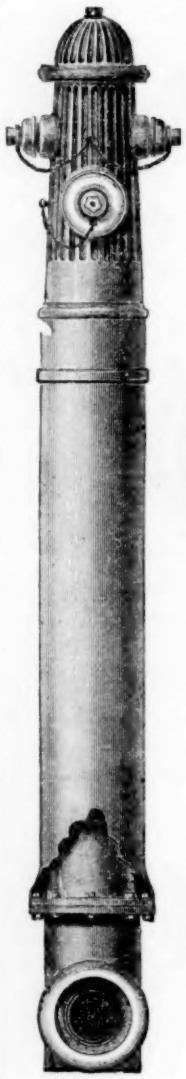

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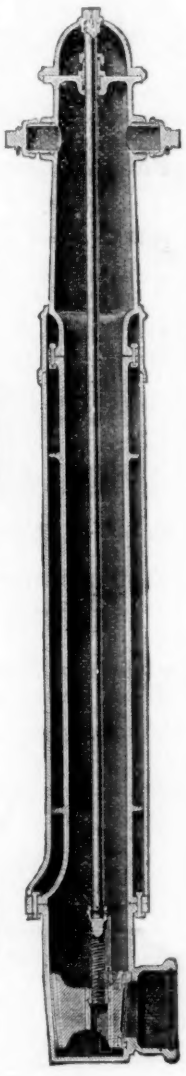

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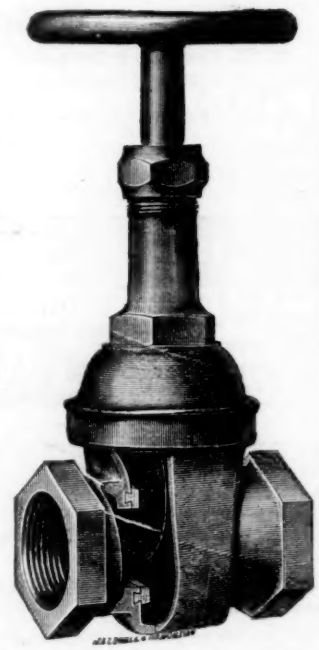

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